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ABSTRACT

The document is the first of a series, to be integrated with a G.E.D. program, containing instructional materials at the basic skills level for the construction cluster. It focuses on wood structural framing and contains 20 units: (1) occupational information; (2) blueprint reading; (3) using leveling instruments and laying out building lines; (4) hand tools and (5) power tools for wood construction; (6) building materials; (7) footer and foundation forms; (8) placement of columns, girders, and floor framing; (9) framing a box sill and floor joist placement; (10) framing openings in floor structures and placing bridging; (11) applying subfloors; (12) laying out stud placement and framing exterior walls and partitions; (13) framing window, door, and other openings in studded walls and partitions; (14) applying double plates and placing ceiling joists, (15) gable roof construction; (16) roof truss construction; (17) hip roof construction; (18) cornice construction and exterior trim; (19) interior trim; and (20) scaffold erection and construction. Each unit includes the following information for the teacher: aim, instructional aids, equipment, and primary references. Introduction and motivation, a presentation of integrated concepts, application, evaluation criteria guidelines, summary, suggested time and sequence listing, and supplemental references and resource materials are also presented. A bibliography is included. (EC)

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Commonwealth of Pennsylvania
Department of Justice
Bureau of Correction

VOCATIONAL EDUCATION PROGRAM OF STUDIES

Elementary, Secondary Education Act

Title I

CONSTRUCTION CLUSTER VOLUME I

2

CE006818

January 1, 1971
Pennsylvania Bureau of Correction

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Harry A. Snyder
Director of Education

INTRODUCTION

The following information comprises one of seven volumes of instructional materials developed around a cluster of Construction Industries and Occupations. These instructional materials are primarily technical in focus but are written to be used in a cluster concept program as part of an integrated curriculum.

The materials are aimed at preparing students with basic skills necessary to enter a number of occupations in industries within the Construction cluster rather than providing an in-depth development of skill in any one occupation.

Each volume contains approximately one hundred twenty hours of instruction (about one month of study) and consists of twenty instructional units each having one or more specific lessons. Each unit is designed for six hours of instruction (three hours of technical laboratory experiences and three hours of related study in science, mathematics, communications and social studies) but may be varied at the instructor's discretion.

The seven volumes or cluster areas in the series are:

Volume I - Wood Structural Framing
II - Masonry Work
III - Plumbing
IV - Concrete Work
V - Electrical
VI - Air Conditioning and Refrigeration
VII - Heating and Ventilation

Students in the Construction cluster should be introduced to the technical and integrated content through several methods closely related to the industrial structure. Among these are line production and assembly, group projects, experimentation, unit studies and independent study. Team teaching techniques should be employed between the academic specialist and the technical specialist and coordinators.

It is recommended that an orientation program be offered students to familiarize them with the cluster areas available so they may select one they wish to pursue. The cluster instruction is designed to integrate with the regular G. E. D. program so students may receive an employable level of skill and a general academic background simultaneously.

As students select the technical cluster areas they wish to study, they should have the option to move through the G. E. D. content at their own speed using programed instructional materials, instructional television, computer assisted instruction and other individualized learning techniques. Technical and integrated concepts are introduced each day by the specialists involved.

After completion of one or more months of work within one cluster, a student could elect to study within another cluster providing, of course, this transfer is agreeable with the counselors, coordinators and instructors involved.

Lessons have been identified in the units. In most cases, however, there is only one lesson since each unit is limited to one

day or six hours of instruction. The units offer the instructor the essential materials, vis-a-vis the aims, instructional aids, topical outline and activities, suggested time sequence, evaluation guidelines, summary and references. The primary and supplemental references are directly related to the topics and are important to the instructors. A selected bibliography is attached at the end of each volume as recommended additional sources of information.

Pagination of the units in this volume has been identified by cluster (C), volume (I, II, etc.), unit (1, 2, etc.) and page (.1, .2, .3, etc.) within each unit.

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INSTRUCTOR'S UNIT PLAN

Unit 1
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Occupational Information

AIM:

To present job requirements, wage scales, working conditions, union involvement, and other occupational information relating to carpentry.

INSTRUCTIONAL AIDS:

Transparencies - Teacher-made, on wage scales, opportunities for employment, types of work, areas of demand, etc.

Chart - Exploring Your Future in Carpentry, Sextant Series, Milwaukee, Wis.: American Liberty Press.

Film - Careers in the Building Trades--Basic Skills, Chicago: Coronet Films, Coronet Building (11 minutes, 16 mm, sound, color, rental).

Film - Careers in Construction, Washington, D. C.: Farm Film Foundation, 1425 H Street Northwest (24 minutes, 16 mm, sound, free).

Record - A Man's Work--Carpentry/Yardman, Personal Job Impressions, New York: McGraw Hill Films, 330 West 42nd Street (L.P.).

EQUIPMENT:

Overhead projector, 16 mm projector, screen, record player, and chalkboard.

PRIMARY REFERENCES:

1) United States Department of Labor, Job Guide for Young Workers, Washington, D. C.: Government Printing Office, 1963-1964, p. 48.

2) United States Department of Labor, Occupations Outlook Handbook, Bulletin 1550, Washington, D. C.: Government Printing Office, 1969, p. 327.

3) Wilkinson, Edward C. (Ed.), Exploring Your Future in Construction, Sextant Series, Milwaukee: American Liberty Press, 1963.

I. INTRODUCTION AND MOTIVATION

A. Arouse interest by asking questions relative to how much a carpenter gets paid, what his working conditions are like, etc. Follow with having students listen to personal impressions interview via the recording A Man's Work--Carpentry/ Yardman.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Identification of job classifications in the construction industry as they relate to carpentry.	1. Areas of specialization or types of work commonly found in the construction industry: a. Superintendent or foreman b. Journeyman carpenter c. Finish carpenter--trim and cabinetwork d. General construction carpenter--light and heavy construction e. Rough carpenter or concrete form carpenter	
B. General job requirements in the various classifications.	1. Description of knowledge and skills required: a. Knowledge required 1) Math 2) Blueprint reading 3) Materials and their uses b. Skills required 1) Hand tool skills 2) Power tool skills 3) Machine tool skills c. Physical skills 1) Good health and vitality 2) Reasonable strength 3) Ability to climb or work at some height	
C. Personal qualifications.	1. Courteous attitude toward colleagues and customers. 2. Ability to cooperate with others. 3. A good attitude toward safety. 4. Interest in quality work. 5. Punctuality and reliability.	
D. Training required.	1. Drafting and blueprint reading in high school, if possible. 2. Knowledge of science and math. 3. Vocational course in carpentry. 4. Apprenticeship programs a. Independent b. Union 5. Age requirements--generally between 17-27 years of age. 6. Wages during apprenticeship. a. Usually paid about 50% of journeyman's wage to start b. Wages are upwardly prorated until they approach 90% of journeyman's wage during the fourth year	1. General discussion of selected science areas as they relate to construction. a. Use of basic machines b. Strength and characteristics of materials c. Concepts of joining and fastening

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Determine salary and wage scales for each classification. 2. Discuss pay periods.		1. The organization of the construction industry and the need for specialization as building becomes larger and more complex. a. Early building and a few workers with broad skills b. Contemporary building with many workers and specialized skills
	1. Common problems of filling out job application forms and performance during job interviews.	
1. Discuss basic computational skills and knowledge needed including: a. Measurement b. Addition, subtraction, multiplication, and division c. Concepts of square, plumb, and level	1. General discussion of communication skills needed: a. Reading and understanding written orders and notes on blueprints b. Reading job and site specifications c. Writing orders for materials and reading and checking delivery invoices	1. A brief chronological review of building technology in which the influences of climate, local materials, and level of the technology are discussed.

III. APPLICATION

A. Involve students as much as possible while presenting wage scales, employment potential, and other aspects of careers in construction. Have men working in the construction industry speak with students.

IV. EVALUATION CRITERIA GUIDELINE

A. Evaluation here is not for grading purposes but to ascertain if students have grasped the career information presented.

B. Use role playing to have students internalize job conditions, physical requirements, and other aspects of the construction.

C. Pose questions relative to various aspects of careers in construction.

V. SUMMARY

A. There are numerous careers in the construction industry; some require much education and experience. However, 70 to 80 percent of the jobs may be entered with reasonable training, particularly as an apprentice. Wages and working conditions are generally good.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and listening to record: A Man's Work--Carpentry/Yardman

60 minutes -- Show films: Careers in the Building Trades--Basic Skills and Careers in Construction

120 minutes -- Role playing

60 minutes -- Integrated curriculum concepts

60 minutes -- Interviews with selected construction workers

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Lasher, Willard K., How You Can Get a Better Job, Chicago: American Technical Society, 1967.

INSTRUCTOR'S UNIT PLAN

Unit 2
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Blueprint Reading

AIM:

To teach how to read, interpret, and understand how to translate the information on the drawing into a building structure.

INSTRUCTIONAL AIDS:

Plans - Plans of several small buildings and houses with details and framing plans.

Film - Building A House, 2nd Edition, Wilmette, Illinois: Encyclopaedia Britannica Films, 1150 Wilmette Avenue (11 minutes, 16 mm, sound, color, rental).

Transparencies - Building Layout--BC-4, Wall Section--BC-7, Floor Plan--BC-8, Foundation Plan--BC-9, Philadelphia: DCA Transparencies, 4865 Stenton Avenue.

Models - Teacher-made models to show details on plans in correct configuration.

EQUIPMENT:

Overhead projector, 16 mm projector, screen, models, and chalkboard.

PRIMARY REFERENCES:

1) Building Trades Blueprint Reading Workbook, Albany, New York: Delmar Publishers, Inc.

2) Dalzell, James R., Blueprint Reading for Home Builders, New York: McGraw-Hill Book Company, 1955.

3) McDonnell, L. P., Carpentry Blueprint Reading and Sketching Residential, Albany, New York: Delmar Publishers, Inc.

4) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Use models to generate interest; then proceed to blueprints to show where sections were developed. Use transparencies to amplify interest and clarify points.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	TECHNICAL CONCEPTS	SCIENCE
A. General overview of orthographic projection.	1. Location of views on a drawing. a. Three basic views b. Auxiliary views c. Sections	
B. Architectural symbols.	1. Show and indicate the purpose and use of architectural symbols--discuss and show: a. Wall symbols b. Partition symbols c. Window symbols d. Door symbols e. Bath fixture symbols f. Kitchen fixture symbols g. Stair symbols h. Electrical symbols i. Plumbing symbols j. Section symbols k. Elevation symbols	1. Discuss the use of symbols in science. a. Elements b. Chemical diagrams c. Physics diagrams 2. Intent is not to provide in-depth understanding but to indicate the use of symbols as a communications medium.
C. Foundation plans.	1. Discuss information contained on these plans. a. Overall and offset dimensions b. Footing sizes c. Wall thicknesses and materials d. Columns, beams e. Stairways, etc.	
D. Floor plans.	1. Discuss information on these plans. a. Dimensions of: 1) Rooms 2) Closets 3) For locations of windows, doors, etc. 4) Equipment arrangement 5) Materials 6) Other b. Materials specified c. Finishes d. Electrical equipment placement e. Plumbing f. Others	
E. Elevations.	1. Discuss all information contained on these drawings.	
F. Section drawings and detail drawings.	1. Discuss the importance of these drawings to show material arrangement, shape detail and other aspects.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Discuss use of symbols in math: a. Algebraic b. Geometric c. Computer 2. Intent not in-depth understanding but understanding the use of symbols as a communications medium.	1. General discussion of the use of symbols in communications. 2. Have students draw pictograms and relate the means of communications to early man.	1. Present early drawings by some noted people such as: a. Michelangelo b. John Watts c. Isaac Newton
	1. Have students read and interpret notes on drawings. Begin to build a technical vocabulary of construction words and terms.	
1. Discuss measurement and fractions. Work problems involving: a. Addition of feet and inches b. Addition of feet, inches, and fraction of inches c. Subtraction, multiplication, and division of feet, inches, and fractions of inches	1. Continue note reading exercise and introduce reading of specifications. Emphasize that information contained in specifications takes precedence over information on drawings. This requires that the written material be properly interpreted.	1. Continue discussion of the development of building and construction. Relate building methods of Egyptians and Early Romans with present-day technology.
	1. Emphasize the necessity of learning and understanding technical terms, words, and symbols used on detail and section drawings.	

III. APPLICATION

A. Discuss plans and show how models represent the material on the drawings. Show film: Building A House. Illustrate orthographic projection and pictorial representation. Explain use of symbols and written information on blueprints. Have students sketch or draw plans and various sections.

IV. EVALUATION CRITERIA GUIDELINE

A. Evaluate student sketches, not for sketch quality, but for understanding of principles.

B. Check understanding of symbols and written material on drawings.

C. Have students explain principle of orthographic projection.

D. Have students develop models to ascertain understanding of sections.

V. SUMMARY

A. Drawing is the language of the construction industry and a construction worker must be able to read and understand the language. The principle drawing methods used are orthographic, section, and pictorial. Written or printed information on the drawings is equally as important as the drawings themselves.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction--show film: Building A House

120 minutes -- Develop principles of orthographic, section, and pictorial drawing

90 minutes -- Student sketching activities

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Bellis, Herbert and Schmidt, W. A., Blueprint Reading for Construction Trades, New York: McGraw-Hill Book Company, 1968.

2) Coover, Shriver L., Drawing and Blueprint Reading, New York: McGraw-Hill Book Company, 1966, 3rd Edition.

3) Coover, Shriver L. and Helsel, J., Drawing and Blueprint Reading Transparencies, New York: McGraw-Hill Book Company, 1966.

INSTRUCTOR'S UNIT PLAN

Unit 3
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Using Leveling Instruments and Laying Out Building Lines

AIM:

To teach how to use the builder's level, transit, and lay out lines of a building, including erection of batter boards.

INSTRUCTIONAL AIDS:

Plans - Blueprints of a house or building with a number of offsets.

Film - Fundamentals of Land Surveying, Berkeley, Calif.: University of California (23 minutes, 16 mm, sound, B & W, rental).

Transparencies - Building Site--BC-1, Footing and Excavation--BC-5, Foundation Plan--BC-9, Philadelphia: DCA Transparencies, 4865 Stenton Avenue.

Transparencies - House Framing--Part I, Harrisburg, Pa.: 3M Company, Business Products Sales, Inc., 2101 N. Front Street.

EQUIPMENT:

Overhead projector, 16 mm projector, screen, chalkboard, builder's level, transit, 2 x 4's, 1 x 6's, hammer, saw, nails, and string.

PRIMARY REFERENCES:

1) Davis, R. E. and Kelly, J. W., Elementary Plane Surveying, New York: McGraw-Hill Book Company, 1967, 4th Edition.

2) Kissam, Philip, Surveying Practice, New York: McGraw-Hill Book Company, 1966.

3) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

4) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Have builder's level and transit set up in lab where students can observe them. Use student interest aroused by the instrument as a lead-in to the film: Fundamentals of Land Surveying.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Leveling instruments.	1. Types of leveling instruments and their nomenclature. a. Carpenter's level b. Line level c. Hand level d. Water level or water bottles e. Builder's level--dumpy level f. Transit or level transit	1. Principle of the spirit level. 2. Concept of water seeking its own level as applied to the hose and glass tube water level. 3. Principle of a "sight line" being a straight line.
B. Principles of topography and contour lines.	1. Contour lines and topographical surveys of site plats. 2. Contour lines on plans showing grading lines for changing building sites. 3. General principles of contour lines and their meanings.	1. Physical aspects of the earth's strata as revealed by the earth's surface.
C. Use of leveling instruments.	1. Setting up the instrument. a. Placement of the tripod b. Mounting the transit on the tripod head c. Leveling the tripod with the leveling screws d. Checking the transit e. Adjusting the telescope 2. Shooting level or grade lines with transit and leveling rod. 3. Use of plumb bob to locate over a point and sight angles.	
D. Laying out building lines.	1. Establishing a square or 90° corner. a. 3-4-5 method b. Use of diagonals c. Transit 2. Erection of batter boards. a. Placement--at least 4'-0" from building lines b. Leveling and nailing of ledger boards c. Cutting saw kerf to locate building lines 3. Checking squareness and dimensions after string lines are strung.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Develop the principle of a level line being a particular type of tangent in respect to the earth's curvature.	1. Terminology as it relates to leveling instruments and their nomenclature. 2. Writing specifications for purchase of leveling instruments.	1. Discussion of methods used by earlier cultures to establish levels for some large structures such as the pyramid, cathedrals, and bridges.
1. Layout of grids for contour information. 2. Use of a plane table.	1. Need for accuracy and correct wording and recording of data. 2. Writing azimuth information.	1. Discussion of some notable historical surveys. a. Mason-Dixon Line b. 54°-40' line c. Etc.
1. Adding and subtracting of level rod or rule and transit to determine slope readings. 2. The use of angles and the concept of degrees, minutes, and seconds.		
1. Development of an understanding of the pythagorean theorem and uses of $a^2 + b^2 = c^2$. 2. Adding multiples of masonry units to establish excavation depth or otherwise determining excavation depth.	1. Reading information on drawings to establish floor elevation and grade lines.	

III. APPLICATION

A. Discuss principles uncovered in the film: Fundamentals of Land Surveying and clarify these points with transparencies: Building Site--BC-1, Footing and Excavation--BC-5. Demonstrate use of builder's level and transit. Have students lay out building lines of house on school lawn or other site.

IV. EVALUATION CRITERIA GUIDELINE

A. Evaluate student understanding of elevations, grades, and reading this information from blueprints.

B. Have students set up, level, and shoot a grade with the transit. Check each step for correctness and accuracy.

C. Check squareness and accuracy of building which students layed out.

V. SUMMARY

A. Buildings must be correctly located, layed out to correct size and shape, and correctly leveled on the site. Knowledge of leveling instruments and their use is essential for building construction. The work is done by engineers on large jobs, but the owner of a small construction company or his foreman usually does the work on small jobs and homes.

VI. SUGGESTED TIME AND SEQUENCE LISTING

50 minutes -- Introduction--show film: Fundamentals of Land Surveying

60 minutes -- Principles of surveying and use of surveying instruments

120 minutes -- Use of instruments--laying out building lines

90 minutes -- Integrated curriculum concepts

40 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Berger, C. L., How to Use Transits and Levels for Faster, More Accurate Building, Boston: C. L. Berger and Sons, Inc., 37 Williams Street (pamphlet, free).

2) Brinker, Russell C. and Taylor, W. C., Elementary Surveying, Scranton, Pa.: International Textbook Company, 4th Edition.

3) Davis, R. E. and Kelly, J. W., Short Course in Surveying, New York: McGraw-Hill Book Company, 1942.

4) Parker, Harry E., Simplified Engineering for Architects and Builders, New York: John Wiley & Sons, Inc., 1967, 4th Edition.

INSTRUCTOR'S UNIT PLAN

Unit 4
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Hand Tools Used in Wood Construction

AIM:

To orient students to the tools used in wood construction and demonstrate the correct and safe usage.

INSTRUCTIONAL AIDS:

Chart - This Is the Industrial Revolution, Des Plaines, Ill.: The Do All Company, 254 N. Laurel Avenue (free).

Chart - Productivity--Creates All Economic Growth, Des Plaines, Ill.: Wilkie Brothers Foundation, 254 N. Laurel Avenue (free).

Chart - Why Living Improves, Des Plaines, Ill.: Wilkie Brothers Foundation, 254 N. Laurel Avenue (free).

Film - Hand Saws, New York: Young American Films, Inc., 18 East 41st Street (11 minutes, 16 mm, B & W).

Film - Claw Hammer and Nail Set, Fort Worth, Texas: Charles Pacey, 3601 London Lane (11 minutes, 16 mm, color).

Filmstrip - Planes, New Britain, Conn.: Stanley Tools, 47D Elm Street (15 minutes, 35 mm, B & W).

Filmstrip - Chisels for Woodworking, New Britain, Conn.: Stanley Tools, 47D Elm Street (15 minutes, 35 mm, B & W).

EQUIPMENT:

Overhead projector, 35 mm filmstrip projector, 16 mm projector, screen, hand saws, hammers, nail sets, crowbar, planes, squares, and chisels.

PRIMARY REFERENCES:

1) Douglass, J. H. and Roberts, R. H., Units in Woodworking, Wichita, Kansas: McCormick-Mathers Publishing Company, Inc., 1962.

2) McDonnell, L. P., Hand Woodworking Tools, Albany, New York: Delmar Publishers, Inc., 1965.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Start class or unit with the social studies area in which discussion is centered around Why Living Improves chart. Build upon concept of tools as an extension of man's arm or strength.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Measuring and layout tools.	1. The measuring and layout tools commonly used in the construction industry: a. 6' folding rule b. 6' to 10' tape rules c. 50' to 100' steel tapes 2. The framing square. a. Laying out stair horses or stringers b. Laying out rafters c. Laying out and checking square corners 3. Tools for laying out angles. a. Bevel protractor b. T-bevel c. Dividers 4. Levels. a. The carpenter's level 1) Lengths and material 2) Uses b. Line level c. Plumb bob	
B. Hand saws and their uses.	1. Describe tooth nomenclature and demonstrate situations and correct saw usage of: a. Rip saws b. Crosscut saws c. Keyhole saws d. Coping saw e. Hack saw	1. Present information on the characteristics of wood fibers and cellular growth as it relates to saw selection and saw tooth shape for efficient cutting.
C. Edged tools and their uses.	1. Planing tools--demonstrate the uses of: a. Jack plane b. Block plane 2. Chisels and their uses. a. Mortising chisels b. Butt chisels c. Flooring chisels	
D. Drilling and boring tools.	1. Selection, correct use and maintenance of boring tools. a. Auger bits b. Forstner bits c. Twist drills d. Bit brace e. Hand drill f. Push drill	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Measurements. a. English by foot, inches, fractions b. Metric 2. Angles. a. Circle division b. Quadrant c. Addition and subtraction d. Laying out or dividing by use of dividers 3. Chart comparing inches to metric measurements.	1. Writing about the advantages and disadvantages of the metric system. 2. Research on the cost of U. S. changing to the metric system.	1. The development of the English system of measurement and the current push to change to the metric system. a. Advantages of the metric system b. Problems related to switching from English to metric
1. Computation of cutting angles of saw teeth--reasons for using saw at a particular angle.		1. Discussion of the industrial revolution by use of Do All Chart <u>This Is the Industrial Revolution</u>. 2. <u>Productivity--Creates All Economic Growth</u>--discuss the influence of tools on productivity.
1. Edged tool geometry and reasons for producing angles to enable efficient cutting.	1. Use of catalogues. a. Tool selection by written description b. Evaluation of written descriptions of tools and materials	1. Discuss American affluence with aid of Wilkie Brothers Chart <u>Why Living Improves</u>.
1. Develop the concept of torque as applied to a bit brace when boring a hole.		

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
E. Striking tools--extracting tools and levers.	1. Discuss and demonstrate the correct use of hammers. a. For hammering nails b. For pulling nails 2. Discuss and demonstrate the use of the ripping bar or "crow-bar" and also the ripping chisel as a tool to extract nails and as a lever.	1. Classes of levers and mechanical advantage gained. Relate information to lever and nail extracting situations in the construction industry.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
		1. Discuss the impact of advances in striking tools on today's society. Consider: a. Hand hammers b. Steam hammers c. Drop hammers d. Jack hammers e. Etc. 2. Develop the concept of functional and dysfunctional aspects of technology.

III. APPLICATION

A. Start lesson with discussion on the improvement of life via increase in productivity--utilize the Do All and Wilkie Brothers Foundation charts. Show films and filmstrips and lead into actual demonstration and student experience with use of tools. Stress importance of safety.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students identify each tool by its correct name.

B. List appropriate safety rules for each group of tools.

C. Have students demonstrate their ability to use selected tools.

V. SUMMARY

A. Through the use of tools and machines, man has increased his ability to change materials to useful products. Also, his rate of productivity has increased. The use of hand tools is important in the construction industry and each student-workman must understand and master their use.

VI. SUGGESTED TIME AND SEQUENCE LISTING

40 minutes -- Introduction and social studies concepts

100 minutes -- Use of visual materials and demonstrating use of tools

120 minutes -- Student experiences with hand tools

60 minutes -- Integrated curriculum concepts

40 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Groneman, Chris H. and Glazener, E. R., Technical Woodworking, New York: McGraw-Hill Book Company, 1966.

2) Wagner, Willis H., Modern Woodworking, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1967.

INSTRUCTOR'S UNIT PLAN

Unit 5
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Power Tools for Wood Construction

AIM:

To teach the correct and safe use of basic power tools used in wood construction.

INSTRUCTIONAL AIDS:

Film - Big Arm of DeWalt: The Power to Build, New York: Sterling Movies, 43 West 61st Street (15 minutes, 16 mm, sound, color, free).

Loop Films - Circular Saw--Sizes and Nomenclature--FAC011, Controls and Basic Operations--FAC021, Special Sawing Operations--FAC031, Sawing and Dadoing--FAC041, Using the Dado Set--FAC051, Using the Molding Cutterhead--FAC061, Philadelphia: DCA Educational Products, 4865 Stenton Avenue (8 mm).

Transparencies - Portable Drill--PT-1, Bayonet Saw--PT-2, Portable Saw--PT-4, Portable Electric Plane--PT-7, Philadelphia: DCA Educational Products, 4865 Stenton Avenue.

Slides - Teacher-made slides of portable tools being used in various situations.

EQUIPMENT:

Overhead projector, 16 mm projector, 8 mm loop film projector, 35 mm slide projector, screen, various stationary and portable power tools.

PRIMARY REFERENCES:

1) McDonnell, L. P., Portable Power Tools, Albany, New York: Delmar Publishers, Inc., 1962.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Show slides of men on construction jobs using various power tools and elicit comments regarding accuracy and labor saving aspects. Capitalize on the labor saving aspects and direct discussion toward the need to know how to use tools for reasons of safety and efficiency.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Power drills.	1. Discuss and demonstrate the correct use of these tools to develop the following concepts: a. Safety b. Size selection--horsepower--for the job at hand c. Types of bits to use	1. Develop the concept of horsepower, particularly as it relates to fractional size motors.
B. Power saws--portable, radial arm, and circular.	1. Discuss and demonstrate to develop concepts of: a. Safety b. Efficiency--time savings c. Versatility d. Accuracy 2. Explain saw tooth shape and have students identify various types of saw blades. 3. Demonstrate and discuss attachments for various saws. a. Dado heads b. Molding cutters c. Special setups	1. Reinforce fiber growth and the structure of wood as it relates to saw tooth nomenclature of power saws. 2. Develop the concept of cutting speed.
C. Planing power tools--jointer and power plane.	1. Discuss and demonstrate the use of these tools to develop: a. Safety b. Uses for hand power planes c. Uses for jointer	
D. Portable router.	1. Demonstrate the use of the router and discuss its versatility. a. Edge shaping b. Dovetail cutting c. Setting hinges d. Cutting stair stringers	1. Develop an understanding of the pantographic principle as it relates to jigs used with the router in production processes.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Develop math skills necessary to enable computation of horsepower problems. 2. Begin math for computation of rpm's, circumference, etc.		1. Discuss interrelations as they relate to technological advances. a. Use of electrical hand power tools in remote areas--cannot be used unless a portable generator is used. Hence, productivity is lower. b. To use most electrical tools requires that the culture be advanced to the degree that electricity is available, otherwise hand processes or other types of power must be used. Hence, there is a definite relationship in technological advances--one thing can rarely advance without another.
1. Develop the concept of using math to determine efficient operations. a. Rpm's times circumference in inches divided by 12 equals surface feet per minute. b. Kick-back speeds. What velocity would a piece of wood be thrown from a circular saw if it were thrown at 100% of potential	1. Use safety as a theme and have students write about safety in terms of: a. Direct statements b. Supportative statements c. Concluding statements 2. Use this material to reinforce safety presented by technical area instructor.	
1. Introduce the concept of flat and true as it relates to a plane surface.	1. Continue building vocabulary words and use these words in sentences. Check sentence structure.	
1. The layout of stairs--rise and run--combined tread and riser dimensions.		

III. APPLICATION

A. Introduce topic with teacher-made slides and discussion. Show films on use of various power tools and then demonstrate the use and safety practice of each power tool. Have each student operate each tool in a variety of situations. Use loop films for reinforcement or review.

IV. EVALUATION CRITERIA GUIDELINE

A. Students should be able to identify each tool and name the important parts.

B. Have students describe important operations of each tool.

C. Have students list safety rules for each tool.

D. Have students demonstrate knowledge of how to use each tool.

V. SUMMARY

A. Power tools play a very important role in the construction industry today and a prospective worker in the construction industry must know the correct and safe use of these tools. It is through the use of tools, to a large extent, that America has the high level of abundance and better housing than most nations.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction

120 minutes -- Show film Big Arm of DeWalt: The Power to Build and demonstrate use of power tools

120 minutes -- Student experiences with power tools

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Lair, E. A., Carpentry for the Building Trades, New York: McGraw-Hill Book Company, 1953, 2nd Edition.

2) Ulrey, Harry F., Carpentry and Building, Indianapolis: Howard W. Sams Company, Inc., 1961.

INSTRUCTOR'S UNIT PLAN

Unit 6
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Building Materials

AIM:

To teach the type, size, and properties of the various materials used in construction.

INSTRUCTIONAL AIDS:

Film - Woodworkers--Americans at Work, Washington, D. C.: AFL-CIO Film Division, 815 Sixteenth Street N. W. (14 minutes, 16 mm, sound, B & W, free).

Film - From Trees to Lumber, Washington, D. C.: American Forest Products Industries, 1816 N. Street N. W. (11 minutes, 16 mm, sound, color, free).

Film - Miracle in Wood, New York: Modern Talking Picture Services, Inc., 1212 Avenue of the Americas (18 minutes, 16 mm, sound, color, free).

Filmstrip - Knock on Wood, Washington, D. C.: National Particleboard Association, 711 14th Street N. W. (35 mm, sound, color, free).

Transparencies - Wood Technology Series, WT-1 thru WT-20, Philadelphia: DCA Educational Products, 4365 Stenton Avenue.

Wood Samples - Teacher-collected samples of various sizes and shapes of construction lumber and man-made building products.

EQUIPMENT:

Overhead projector, 16 mm projector, 35 mm filmstrip projector, screen, samples.

PRIMARY REFERENCES:

1) A Teacher's Manual, Washington, D. C.: American Forest Products Industries, 1816 N. Street N. W. (free).

2) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Have wood samples in view of class to help generate interest. Show film: Woodworkers--Americans at Work and lead discussion to the need to know about construction material.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Wood structure and growth.	1. An understanding of how a tree grows and the structure of wood adds to the body of knowledge which enables the worker to better utilize the products of the forest. Discuss: a. Fibers or tracheids b. Lignin c. Medullary rays	1. Develop the biological concepts related to tree growth. a. Water and carbon dioxide b. Growth in the cambium layer c. Springwood and summerwood d. Heartwood 2. Develop an understanding of deciduous and conifers as they relate to hardwood and softwood and the actual hardness of the woods. 3. Develop ecological concepts and reforestation principles.
B. The lumbering industry. 1. Sawing methods. 2. Drying methods. 3. Wood by-products.	1. Develop an understanding of the methods of cutting trees into lumber. a. Plain or slab sawn b. Edge grain--softwoods c. Quartersawn--hardwoods 2. Seasoning lumber. a. Air dried b. Kiln dried c. Chemical dried 3. Manufactured wood. a. Hardboard b. Plywood c. Chip or flakeboard 4. Wood chemistry. a. Dyes b. Medicines c. Distilates	1. Experiment with wood drying--develop concept of 100% water in cells--fiber saturation point--and usable dry wood. 2. Discuss role of lignin in the manufacture of hardboard. 3. Experiment with distillation to teach concepts of evaporation and condensation.
C. Lumber defects.	1. Develop an understanding of the major lumber defects. a. Knots b. Splits and checks c. Wane d. Warp e. Etc.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Develop an understanding of the quantity of wood obtained from a tree by using volumetric computations.	1. Continue development of technical vocabulary. 2. Have students research some aspect of tree growth and write several descriptive paragraphs on the findings.	1. Discuss the exploitation of virgin forests by early lumbermen. 2. Consider the role that virgin forests played in the settlement of America by early colonists. 3. Discuss aspects of National Forests and ecology--expand to green belt concept in urban areas.
1. Computation of board foot: a. Formulas 1) Thickness in inches times width in inches times length in inches divided by 144 2) Thickness in inches times width in inches times length in feet divided by 12 2. Computation of area for plywoods, hardboards, etc. 3. Determination of moisture content in wood by weight difference between green and dry wood. a. Subtraction b. Division c. Formula Moisture Content = $\frac{\text{Initial Wt. - Oven Dry Wt.}}{\text{Oven Dry Wt.}}$	1. Write up the moisture content experiment as a problem solving situation.	1. Quantities of wood used in America. 2. The economic effect or role of the lumbering industry in our society.
	1. Write letters to various lumber associations requesting information on lumber grading.	1. Discussion on lumber grading. Develop concepts relative to general consumer knowledge.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
D. Types of wood and their uses.	1. Develop an understanding of the various properties of common construction woods. a. Construction wood b. Finish wood c. Cabinet wood d. Plywood e. Manufactured wood	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
	1. Write compositions on the manufacture of man-made materials such as: a. Hardboard b. Flakeboard c. Plywood	1. Discuss the effect of manufactured materials on the construction industry and society in general.

III. APPLICATION

A. Start class with film: Woodworkers--Americans at Work. Elicit response to film and follow up with Miracle in Wood (plywood manufacture and use) or From Trees to Lumber. Utilize the Wood Technology Series of transparencies and finally, reinforce the presentation with showing of actual building material samples. Integrate science concepts throughout.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students develop a sequential progression or process chart from tree to finished lumber.

B. Have students write a paper on the ecological importance of reforestation.

C. Have students identify various wood samples.

V. SUMMARY

A. There are many sizes and types of wood and man-made wood products used in the construction industry. The construction worker must know and be able to identify various sizes of wood and types so that correct usage and strength properties can be realized.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and showing film: Woodworkers--Americans at Work

20 minutes -- Film: Miracle in Wood

120 minutes -- Discussion about various types of wood

130 minutes -- Integrated curriculum concepts

60 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Hepler, D. E. and Wallach, P. I., Architecture: Drafting and Design, New York: McGraw-Hill Book Company, 1964.

2) Lair, E. A., Carpentry for the Building Trades, New York: McGraw-Hill Book Company, 1953, 2nd Edition.

3) Smith, R. C., Materials of Construction, New York: McGraw-Hill Book Company, 1966.

4) Ulrey, Harry F., Carpenters and Builders Library, Vol. I, Indianapolis: Howard W. Sams Company, Inc., 1953.

INSTRUCTOR'S UNIT PLAN

Unit 7
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Footer and Foundation Forms

AIM:

To familiarize students with methods of erecting footer and foundation forms.

INSTRUCTIONAL AIDS:

Plans - Blueprints of the house for which batter boards were erected in Unit 1.

Transparencies - Building Site BC-1, Footings and Excavation BC-5, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - House Framing Part I, #15-0890-2, Harrisburg: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Film - Building A House (2nd Ed.), Wilmette, Illinois: Encyclopaedia Britannica Educational Corporation, 1150 Wilmette Avenue (11 minutes, 16 mm, sound, color).

Film - Foundations and Concrete, New York: Du Art Film Labs, Inc., 245 West 55th Street (26 minutes, 16 mm, sound, B & W).

EQUIPMENT:

Overhead projector, 16 mm projector, screen, chalkboard, transit, 2 x 4 stakes, 2 x 6 or 2 x 8's for footer forms, sledge hammer, hammer, nails, string, crosscut saw.

PRIMARY REFERENCES:

1) Spence, William P., Architecture-Design-Engineering-Drawing, New York: McKnight & McKnight Publishing Company, 1967.

2) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Show film Building A House and direct attention toward footing and foundation aspects. Utilize transparencies to continue interest and amplify forming processes.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Excavation of foundation.	1. Establishing depth of excavation. a. By studying section drawings b. By locating floor level according to elevations in relationship to bench marks 2. Developing or making a story pole for the excavator. 3. Extra width and length of excavation. a. To enable footing forming b. To provide for clearance for concrete block masons or concrete forming	1. Develop the principle of geodetic surveys and bench or reference elevations.
B. Footing design.	1. Factors influencing footer size. a. Bearing soil conditions b. Building weight c. Live and dead loads 2. Standard footing design for residential construction. a. Thickness--usually eight inches b. Width--two times the thickness of the wall it will support 3. Wall footing and column footing design as required by building weight. a. Dead load of material bearing on each lineal foot of the footing 1) Weight of foundation 2) Weight of wall structure 3) Weight of floor structure 4) Weight of ceiling structure 5) Weight of roof structure b. Live load which will act on the structure 1) Weight of: a) People b) Furnishings c) Storage d) Wind e) Snow c. Areas supported by foundation and columns	1. Develop the concept of various types of soils or subsurface strata. a. Bearing capacities of various soils b. Effects of climate--frost and rain 2. Experiment with materials to establish the relationship of density to weight.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Compute the volume of earth to be excavated. a. V = l x w x h b. Average depth 2. Compute necessary extra width and length for foundation clearance.	1. Reading of notes on drawings and weights of materials. 2. Develop vocabulary relative to the construction industry, particularly as it relates to excavation.	1. Development of building codes to protect home owners and communities from unfair building practices. a. Frost line depths b. Footing sizes c. Concrete composition 2. Relate to consumer knowledge and current consumer protection legislation.
1. Develop the concept of a square foot. 2. Computation of weight per lineal foot. a. Solid wall material b. Material such as studs placed 16" on center 3. Totaling of weights of various components of a structure to find weight bearing on each lineal foot of footing. 4. Computation of area of the building supported by a column.	1. Reading and interpreting technical literature to establish weights of various materials.	1. The impact of technology on the weight of material and the resultant impact on building design and community development.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
C. Setting footing forms.	1. Establishing grade stakes. a. Set to establish level b. Set to establish correct depth 2. Setting corner stakes. a. Locate at correct location b. Stretch string between stakes 1) Align footer form boards 2) Stake at appropriate distances to prevent pushing of footers 3. Measure width of footing and establish level. a. Use spreaders or stretchers to maintain width b. Place footer form--stake 4. Dig footer bottom level and to correct depth below top of footer form. a. Remove loose dirt b. Footer bottom must rest on virgin undisturbed soil even if it requires more concrete	1. Develop the concept of the footing being a platform floating on the bearing soil which supports the weight of the building.
D. Stepped footing.	1. Maximum vertical height. 2. Maximum-minimum horizontal length.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Compute the volume of concrete required to pour the footings. a. Develop the concept of cubic foot and yard 2. Discuss proportion as it relates to various concrete mixes. a. 1-2-3--3000 psi concrete b. 1-2 1/2-3 1/2--2500 psi concrete c. 1-2-4--2500 psi concrete	1. Exercises in writing orders for concrete and other materials.	
1. Develop the concept of multiple units and the necessity of designing parts of construction structures to accommodate the units. a. Stepped footings must be a vertical multiple of 8" if they are to match b. Horizontal lengths must be a multiple of 16" or the length of a concrete block		1. The effect of multiple units as a mass produced medium in the building industry.

III. APPLICATION

A. Begin with film Building A House; amplify and clarify footing and foundation forming processes with transparencies and discussion.

B. Show film Foundations and Concrete to explain more complex forming methods. Have students actually set corner and grade stakes and erect footing forms of house staked out in Unit 1. Erect concrete step forms in lab as a mock-up.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students explain need for level, adequate strength footing.

B. Have students describe a stepped footing.

C. Check on knowledge of step proportions--riser-tread relationship.

D. Check knowledge of proper staking to prevent concrete from pushing the forms.

V. SUMMARY

A. Forming and locating footing forms is an important aspect of starting any building. The footings must be properly located, of adequate size, and formed on virgin soil. Correct placement of footing forms is essential. If foundation walls are to be of poured concrete, forms must be placed to contain the concrete until it hardens. Workmen must develop the knowledge and skill necessary to properly erect concrete forms.

VI. SUGGESTED TIME AND SEQUENCE LISTING

20 minutes -- Introduction--Film Building A House

40 minutes -- Amplify forming processes--Show film Foundations and Concrete

210 minutes -- Student practical activity

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Wilson, Douglas J., Practical House Carpentry, New York: McGraw-Hill Book Company, 1957.

INSTRUCTOR'S UNIT PLAN

Unit 8
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Placement of Columns, Girders, and Floor Framing

AIM:

To present methods of erecting columns, girders, and steel beams for small building floor structures.

INSTRUCTIONAL AIDS:

Transparencies - Teacher-developed transparencies indicating construction methods of girders, various types of columns, cribbing for supporting steel beams during placement, and other related materials.

Slides - Slides of various column and beam structures, teacher-made from various local building sites (35 mm).

Mock-Ups - Mock-ups or models of column and girder and beam construction.

EQUIPMENT:

Overhead projector, 35 mm slide projector, screen.

Samples of steel columns, I beams, wide flange beams, channel iron and other steel shapes used in light construction.

PRIMARY REFERENCES:

1) Spence, William P., Architecture-Design-Engineering-Drawing, New York: McKnight & McKnight Publishing Company, 1967.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Introduce lesson and use slides to show various beams and girders in place. Elicit student response concerning methods of placing beams without the use of a crane.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Girders and their construction.	1. Solid wood girders. a. Availability b. Problems of controlling twist c. Strength 2. Built up girders. a. Nailing schedule b. Joint staggering c. Strength	1. The principle of solid wood vs. laminated or nailed wood beams. a. Odd number of structural members glued or nailed together to help maintain equilibrium 2. Fiber strength of various species of wood.
B. Steel beams.	1. Types. a. I Beams - standard b. Wide flange beams 2. Spans and strength. a. Weight per lineal foot as it relates to strength b. Lateral deflection and strength	1. Discuss and develop an understanding of the strength obtained in a rolled shape (I beam) because of its shape.
C. Placing girders and beams.	1. Methods of placing beams. a. By crane b. By gin pole c. By sliding and cribbing 2. Beam bearing. a. On side walls--foundation b. Pocket clearance 1) Side clearance 2) End clearance c. Use of pilasters to increase foundation rigidity and bearing surface	
D. Erecting columns.	1. Methods. a. Base plate of steel. Pipe column anchored by concrete floor b. Base column bolted to footing c. Wood column center on pin d. Wood column in mechanical "U" bracket 2. Column connection to beam by girder. a. Bolted in place with bearing plate b. Bearing plate welded to beam	1. Discuss the strength of a cylindrical section (pipe column) as opposed to other sections. a. Demonstrate length-strength relationship b. Demonstrate the vector principle as it relates to a column out of plumb

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Stiffness formula-- $S = D^3$ a. Stiffness = Depth cubed 2. Strength formula-- $S = D^2$ a. Strength = Depth squared 3. Develop the concept of stiffness increasing more rapidly as the depth of a structural member increases, e.g., a 2 x 4 is 8 times as stiff as a 2 x 2, but only 4 times as strong.	1. Do research on the strength characteristics of various structural woods.	1. Discuss the reasons for the construction industry using more steel for home floor joist supports than wood. 2. Discuss the effect of Glue-lam or other laminated beams in contemporary construction.
1. Develop an understanding of how to use Safe Load Tables for various steel and wood beams.	1. Develop an understanding of the word kip since it will frequently appear on Safe Load Tables.	1. Study the steel industry: a. Its location and reasons for the same b. Its economic impact c. The effect of strikes on the construction industry
	1. Develop a concept of other means of communication besides written and spoken words. a. Hand signals to crane operators b. Other visual signals where distance is too great for spoken word	
1. Conduct experiments on the compression strength of various column materials and use data obtained to develop comparative strength tables. a. Compare test findings with published tables b. Reinforce ratio and proportion		1. Discuss changes in life style which enabled the slab type home to become popular. a. Concept of smaller families b. Higher price of construction c. Mass production approaches

III. APPLICATION

A. Have students suggest methods of placing girders and beams without the use of a crane. Use transparencies and slides to show configuration, shape, and size of structural components. If possible, have students erect full size components in a practice structure. Provide practical experience in nailing together wood girders.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students select correct girder or steel beam for a given span.

B. What method of fastening column plate to girder is most used?

C. Explain several methods of placing steel beams on columns and foundations.

V. SUMMARY

A. The wood girder or steel beam supported on pipe columns and the foundation wall is most frequently the main support through the center of a small building or house. If the total structure is to be sound, care must be taken to assure proper size and span characteristics of girders and beams. Steel beams are heavy and care must be taken when locating them on columns and foundations so that workers are not injured.

VI. SUGGESTED TIME AND SEQUENCE LISTING

20 minutes -- Introduction

40 minutes -- Principles of girder, beam, and column sizing

90 minutes -- Integrated curriculum concepts

180 minutes -- Practical application

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Johnson, James F., Applied Mathematics, Milwaukee: Bruce Publishing Company, 1965.

2) Ketchum, Milo S., Handbook of Structural Details for Buildings, Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1956.

INSTRUCTOR'S UNIT PLAN

Unit 9
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Framing a Box Sill and Floor Joist Placement

AIM:

To teach how to frame a box sill and how to place and attach floor joists.

INSTRUCTIONAL AIDS:

Transparencies - Sill Foundation Construction AD-15, Sill Anchoring BC-10, Setting Joists BC-11, Floor Framing Plan BC-12, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - House Framing Part II, #15-0891-0, Harrisburg: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Film - Building A House (2nd Ed.), Wilmette, Illinois: Encyclopaedia Britannica Educational Corporation, 1150 Wilmette Avenue (11 minutes, 16 mm, sound, color, rent).

Models - Teacher-developed models of various sill framing methods. Suggest large scale models or perhaps short sections of full size mock-ups.

EQUIPMENT:

Overhead projector, 16 mm projector, screen, anchor bolts of various types, 2 x 8 or 2 x 10 for mud sill, 2 x 10 for box and floor joists, necessary saws, hammers, nails, and wrenches.

PRIMARY REFERENCES:

1) Chamberlain, L. S., Related Mathematics for Carpenters, Chicago: American Technical Society, 1957.

2) Jones, R. P., Framing, Sheathing, and Insulation, Albany, New York: Delmar Publishers, Inc., 1964.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Introduce and show film Building A House; direct attention to the box and sill framing. Discuss the importance of proper anchoring practices since the floor structure and foundation combined largely determine the soundness of a building. Use transparencies to amplify interest.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Sill construction.	1. Selection of material for sill. a. Size as it relates to foundation wall width and type of construction b. Thickness c. Wood species 2. Sill sealers and their uses. a. Resilient b. Semirigid 3. Termite shields a. Types b. Function 4. Drilling for anchor bolts and installing sills a. Locating and boring holes b. Use of washer and nut to hold sill in place c. Properly align sill	1. Study of termites and their life cycle. a. Developmental stages b. Adult stages c. Migration and new colonies 2. Destructive aspect of termites and the necessity of preventative measures in construction.
B. Placement of sill or nailer on girder or beam.	1. Procedures in which beam or girder is fully exposed in the basement. a. Attaching sill to steel beam with bolts b. Attaching sill to steel beam with lag screws c. Maintaining level with foundation wall sill 2. Procedures in which beam is flush with underside of floor joists. a. Attaching ledger on girder b. Use of joist stirrup or framing anchors c. Bolting nailer to steel beam and coping floor joists 1) Clearance	
C. Placement of the box framing member on the sill.	1. Laying out joist spacing. a. Spacing on center (o.c.) as per drawings b. Actual method of laying out 2. Arrangement for placement of double joists. a. Under partitions b. At floor openings c. At points of unusual weight	1. Weight and nailing considerations for double joists. a. Increase in strength b. Value of toenailing over straight nailing in some situations

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Adding and subtracting whole numbers and fractions to determine placement and sizing of sill material. a. Sizes and placement of materials b. Air spaces	1. Letter writing to various lumber supply companies requesting information on basic sizes of materials. a. Size of lumber under new grading system b. Size of bricks, blocks, etc. 2. Place emphasis on correct grammar and clarity of expression.	1. Study the Federal Housing Administration (FHA) Minimum Property Requirements and determine how these aid in improving housing and protect home owners.
		1. Study methods whereby the home owner can effectively evaluate whether the floor structure is properly designed.
1. Calculate or compute the running dimensions used for laying out floor joists. a. Use the joist spacing b. Select working edge c. Add cumulative spacings so that joist layout could be achieved by a tape	1. Read and interpret specifications or building codes relative to placing double joists.	

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
D. Selecting and placing floor joists.	1. Selection of floor joist sizes. a. Joist spacing b. Span c. Size of joist 1) Use of computation 2) Use of span and floor joist tables d. Floor joist loading 1) Live load 2) Dead load e. Allowable deflection 2. Blocking or spacing double joists under partitions to provide nailing edges as well as necessary support.	1. Holding power of nails in various mediums and when nails are driven in various ways. 2. Study of the forces acting on joist stirrups or framing anchors. a. Consider forces b. Consider vectors
E. Balloon framing.	1. Present basic principles of balloon framing. a. Consider balloon as it influences the sill construction and fire-stopping.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Develop knowledge and ability to compute correct size floor joists. a. Study fiber strength of various framing woods b. Compute loading placed on floor joists 2. Develop an understanding of how to use joist span tables with various spacing and loads.		1. Study some examples of building collapse and extract from the study some of the protective legislation which has resulted.

III. APPLICATION

A. Introduce unit with film Building A House. Use transparencies, models, chalkboard, and demonstrations to amplify and solidify understanding of construction methods. Refer to math and science presentations relative to joist selection and nailing practices. Have students actually cut, nail, and totally assemble a box sill section and a balloon framing section. For more complete understanding, have groups of students build complete models. The model can be completed to the joist level at this time and added to in later lessons.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students sketch the correct box sill construction for both brick veneer and frame construction.

B. List three methods of placing joists so that the girder will be flush with underside of floor joist.

C. Have students demonstrate correct usage of floor joist span tables for a given wood species, joist centering, span, and load.

D. Have students indicate location of double joists from a given floor plan.

V. SUMMARY

A. Joist selection, spacing and placement is a very important part of building construction. The total house structure rests to a large degree on the platform formed by the box sill, floor joists, and subfloor. Correct selection and placing of joists is also important to provide the correct floor level, openings for stairwells, fireplaces, and support of partitions, bathtubs and other heavy objects. Hence, prospective carpenters should know correct methods of erecting floor structures.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction--Show film Building A House

60 minutes -- Discussion and presentation of methods of sill and joist framing

90 minutes -- Integrated curriculum techniques

160 minutes -- Practical application, model making

20 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) United States Department of Agriculture, Preventing Damage to Buildings by Subterranean Termites and their Control, Farmer's Bulletin 1911, Washington, D. C.: U. S. Government Printing Office, 1949.

2) United States Forest Products Laboratory, Prevention and Control of Decay in Dwellings, Technical Note 251, Washington, D. C.: U. S. Government Printing Office, 1953.

INSTRUCTOR'S UNIT PLAN

Unit 10
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Framing Openings in Floor Structures and Placing Bridging

AIM:

To familiarize students with correct methods of framing openings in floor structures and how to place various types of bridging.

INSTRUCTIONAL AIDS:

Transparencies - Setting Joists BC-11, Floor Framing Plan BC-12, Floor Framing Section BC-13, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - House Framing Part I, #15-0890-2, House Framing Part II, #15-0891-0, Harrisburg: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Slides - Teacher-made slides of framing around stairs, fireplaces, and other openings in floor structures.

Models - Teacher-made models or mock-ups showing the configuration of the headers and trimmers around openings.

EQUIPMENT:

Overhead projector, 35 mm slide projector, screen, necessary wood, saws, hammers, and nails to assemble headers and trimmers.

PRIMARY REFERENCES:

1) Durbahn, Walter E. and Sundberg, Elmer W., Fundamentals of Carpentry, Vol. II--Practical Construction, Chicago: American Technical Society, 4th Edition.

2) Lair, E. A., Carpentry for the Building Trades, New York: McGraw-Hill Book Company, 1953, 2nd Edition.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Open the class with discussion about how floor joists would remain in place when openings such as a stairwell would be cut in the floor structure. Elicit ideas about how to support the floor joists and direct class to correct methodology.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Openings for stairwells.	1. Openings in which the major dimension is parallel with the floor joists. a. Doubling of joists on each side of the opening 1) Trimmer joists b. Since the major axis is with the joists, the cut off joists are usually relatively short 1) Tail joists c. Joists used to support the tail joists 1) Headers 2. Openings in which the major dimension is perpendicular to the run of the floor joists. a. Placement of the trimmer joists b. Since the major axis is perpendicular to the run of the joists, the cut off joists (tail joists) are relatively long c. Header joists are usually relatively long d. It may be necessary to use a post or column to support header at trimmer juncture	1. Discussion of the lever principle at work in regard to the tail joists and hence the need for rigid header support. 2. Discuss the increase of lever action due to the tail joist being longer. a. Discuss methods of increasing header support. 3. Develop discussion of levers to include all classes of levers and the value of understanding lever action to aid in doing work. a. Relate levers to hammers b. Relate levers to pry bars c. Relate levers to pliers d. Etc.
B. Openings for fireplaces.	1. Openings near exterior walls a. Parallel with run of floor joists in major axis b. Perpendicular to run of floor joist in major axis 1) Same principles apply as for stairwells 2. Openings within the interior of the building. a. Parallel with run of floor joists b. Perpendicular to run of floor joists 3. Methods of gaining support for headers and trimmers from fireplace foundation. a. Cautions relative to fire prevention 4. Fire cuts on joists in masonry construction. 5. Forming procedures for rough hearth	1. Methods of providing fire protection. a. Flash points of various materials b. Fire resistant qualities of various materials 1) Asbestos 2) Fiber glass

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Computation of opening length and width. a. As required by rough opening b. As required by finished opening 2. Compute mechanical advantage gained by various classes of levers in various applications.	1. Continue building technical vocabulary. 2. Read about the lumbering industry and write essays on the articles. 3. Read fiction relating to the lumber industry. 4. Write requisitions for lumber required for floor framing; specify size, quantity, and type in proper order.	1. The lumber industry: a. Forest management b. Modern day lumberjacks c. Sawing procedures d. Milling procedures 2. Study the organization, shipping, and marketing procedures. 3. Discuss the impact of technology, modern business organization, and marketing procedures and the effect of these items on wages, standard of living, and life styles of contemporary society.
1. Check on fire resistant qualities of various materials. a. Compute time factors b. Compute heat problems 1) Problems of Fahrenheit conversion		1. Fire regulations and fire companies as examples of social action and social organizations which evolved as a result of social need. 2. Discuss fire insurance and develop understandings of basic insurance types.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
C. Header and trimmer nailing and support methods.	1. Sequence of cutting and nailing. a. Cut tail joists b. Cut headers c. Nail first header in place through the joist--nail tail joists to header d. Nail second header in place e. Nail headers to each other f. Repeat process for other set of headers g. Nail trimmer joists in place h. Nail framing hangers in place, if required 2. Maintain joist spacing so that installation of subflooring is facilitated.	
D. Installing bridging.	1. Cross bridging. a. Method of computing length and angle cuts b. Nailing procedure c. Use of steel or manufactured bridging 1) Types 2) Installation 2. Solid bridging or blocking. a. Cutting procedures b. Nailing procedures 3. Purpose and function of bridging. a. Bridging spacing b. Preventing joist twist	1. Strength factors involved in use of bridging. a. Preventing twist b. Load distribution 2. Function of bridging to assist in leveling top of floor joists.

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Study of nail sizing systems to enable understanding of the penny system and its relationship to length. 2. Review joist spacing and multiples of basic material lengths and widths.		1. Study the waste, if any, of the lumber industry. How has research and technological development resulted in man-made products?
	1. Write about the importance of bridging in floor framing . a. Discuss and look for the logic in the writing b. Continue to develop correct methods of expression with emphasis on exactness of expression so that misunderstandings do not develop	

III. APPLICATION

A. Introduce lesson and develop the need for openings in floor structures and the need for strength in the structure. Demonstrate installation and nailing procedures in regard to trimmers, headers, tail joists, and regular joists. Demonstrate application of bridging. Have students do full-scale work to gain practical experience. Have students apply floor joists, etc. in their models.

IV. EVALUATION CRITERIA GUIDELINE

A. What function does the double header serve?

B. Are double joists used on each side of openings in the floor structure? What are they called?

C. How is the area around a fireplace framed?

D. How is the framing for a fireplace hearth structured?

V. SUMMARY

A. When openings are cut in floor joists for stairs, fireplaces, and other openings, it is necessary to place double joists and headers to support the floor structure. Special joist configurations are also necessary to support fireplace hearths. The carpenter must know how to frame for these openings since they are not always detailed on the blueprint.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction

60 minutes -- Use of slides, transparencies, and demonstration to present technical aspects

60 minutes -- Integrated concepts

180 minutes -- Practical application

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Ramsey, Charles G., Architectural Graphic Standards, New York: John Wiley & Sons, Inc., 1956, 5th Edition.

2) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

INSTRUCTOR'S UNIT PLAN

Unit 11
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Applying Subfloors

AIM:

To familiarize the student with the methods of application of plywood and solid wood subfloors.

INSTRUCTIONAL AIDS:

Transparencies - Framing Plans - Floor AD-22, Floor Framing Section BC-13, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - House Framing Part II, #15-0891-0, Harrisburg: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Slides - Teacher-made slides showing plywood, tongue and groove, and S4S subfloor placement. Also, slides of various nails and nailing machines used.

EQUIPMENT:

Overhead projector, 35 mm slide projector, screen, hand saw, portable electric saw, hammer, nails, various types of wood used for subflooring.

PRIMARY REFERENCES:

1) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

3) Wilson, Douglas J., Practical House Carpentry, New York: McGraw-Hill Book Company, 1957.

I. INTRODUCTION AND MOTIVATION

A. Have students develop ideas relative to using the subfloor as a platform on which to work while building the rest of the house. Develop concepts of strength and rigidity by use of nailing and joint spacing procedures. Have examples of various subfloor materials on hand for student inspection.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Types of subflooring material.	1. Solid or natural wood used for subflooring. a. Yellow pine b. White fir c. Eastern hemlock d. Western larch 2. Wood finishes or mill planing. a. 1 x 6 S1S1E b. 1 x 6 S2S2E c. 1 x 8 S2S2E d. 1 x 6 T & G 3. Man-made subfloors. a. Fir plywood b. Various fiber or chip-boards 1) Usually as overlay	1. Examine wood shrinkage and swelling patterns. a. Greatest shrinkage tangential b. Second greatest shrinkage across or perpendicular to annual rings c. Least shrinkage with length of grain 2. Discuss reasons for dimensional stability of plywood members. 3. Experiment with water resistant qualities of adhesives used in construction or sheathing grade plywoods.
B. Planning for application of subflooring.	1. Board direction patterns. a. 45° to joists 1) Rigidity factors 2) Enables finish floor to be nailed either direction b. 90° to joists 1) Rigidity factors 2) Finish floor usually nailed or layed perpendicular to sub-floor boards 2. Waste in subfloor patterns. a. Approximately 1/3 with 45° placement b. Somewhat less than 1/3 with perpendicular placement 3. Plywood application. a. Perpendicular to joists b. Thicknesses c. Solid bridging at edges for thinner subfloors and where overlay for tile or linoleum is used	1. Review bracing and rigidity aspects of 45° and 90° subfloor applications.
C. Subfloor application.	1. Starting with a straight line and maintaining a straight line of board or plywood edges. 2. Nailing schedules. a. Two 8d nails for boards under 8" in width b. Three 8d nails for 8" boards c. 8d nails 6" on center for plywood	1. Review shrinkage-swelling consideration presented earlier in this lesson.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Develop concept of weight gain or loss by addition or loss of moisture in wood.	1. Expand knowledge of common abbreviations or symbols used in construction. a. Present meanings of: 1) S1S1E 2) S2S2E 3) 1 x 6 T & G 4) Plywood classifications: a) A b) B c) C d) D e) AD f) Etc. b. Add these definitions to students' vocabulary listing	1. The effect of geographical location on moisture patterns. a. Moisture in the seaside areas b. Moisture over lowland and foothills c. Moisture over mountainous areas d. Moisture in desert areas 2. Relate geographic location to expansion-contraction of wood due to moisture gain or loss.
1. Figuring percentages of waste in estimating material required for subflooring. a. Consider actual width of milled boards b. Consider end waste when boards must be cut to make joint on joists c. Consider waste of 45° cuts 2. Develop concept of percentage in other problem areas.		1. Study of FHA Minimum Property Requirements as they apply to subflooring.
1. Develop the concept of amplification of error. a. An error of 1/32" out of square in one foot will expand into 1/2" over a 16'-0" board		

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
	3. Breaking joints. a. All joints made on a joist or solid bridging b. 1" x 6" or 1" x 8" break at least one joist spacing c. Plywood break at 4'-0" where possible or one joist space minimum 4. Consideration for rain. a. Leave open joints about every 4'-0" of laid floor width to prevent floor buckling by wood swelling	

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES

III. APPLICATION

A. Use transparencies and slides to present floor structure and elicit response in regard to where to start and how to place and break joints in subfloor application. If a full size platform is used, have students apply subflooring in various manners. If students are building models, have students in various groups apply subflooring in different ways. Discuss joint breaking, nailing schedules and other pertinent aspects.

IV. EVALUATION CRITERIA GUIDELINE

A. Why is it important to layout plywood subfloor in relation to the joist spacing?

B. What does breaking joints mean?

C. What nail spacing is used for plywood subfloors?

D. Why are expansion breaks provided in solid wood subfloors?

E. What does 1" x 6" Y.P.-T.G. stand for?

V. SUMMARY

A. The correct placement of subfloor material adds much to the rigidity and stability of the floor structure. It is important that the correct thickness of plywood be selected and properly placed and nailed. Also, if solid matched wood subflooring is used, it should be placed diagonally to produce the greatest rigidity. Since it is quite possible that rain may fall on the subfloor before it is under roof, provisions must be made for expansion of the wood as it takes on moisture.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and motivation

60 minutes -- Science experiments

60 minutes -- Integrated curriculum concepts

180 minutes -- Practical application

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Chamberlain, L. S., Related Mathematics for Carpenters, Chicago: American Technical Society, 1957.

2) Hammond, James J. et al., Woodworking Technology, New York: McKnight & McKnight Publishing Company, 1966.

3) Spence, William P., Architecture-Design-Engineering-Drawing, New York: McKnight & McKnight Publishing Company, 1967.

INSTRUCTOR'S UNIT PLAN

Unit 12
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Laying Out Stud Placement and Framing Exterior Walls and Partitions

AIM:

To present considerations required for correct layout for stud placement and correct nailing procedures for wall and partition members.

INSTRUCTIONAL AIDS:

Transparencies - Floor Plan--Its Relation to the House AD-2, Symbols for Typical Walls AD-3, Dimensioning--Frame AD-9, Information and Notes AD-10, Dimensioning--Masonry AD-11, Framing Elevations AD-24, Corners BC-14, Wall Assembly BC-15, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - House Framing, Part II, #15-0891-0, Harrisburg, Pa.: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Slides - Teacher-made slides of various stud wall configurations to point out methods of assembling stud walls.

Models - Teacher or student-constructed models to show corner stud arrangements, bracing, and nailing surface provisions at partition junctures.

EQUIPMENT:

Overhead projector, 35 mm projector, screen, 2 x 4's for studs and plates, 2 x 6 for corner post construction, saws, squares, hammers, nails, carpenter's level.

PRIMARY REFERENCES:

1) Jones, R. P., Framing, Sheathing, and Insulation, Albany, New York: Delmar Publishers, Inc., 1964.

2) Newman, Morton, Standard Structural Details for Building Construction, New York: McGraw-Hill Book Company, 1968.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. At this stage in house construction a reasonable amount of work on the wall structure reflects large assemblies and it really looks as if considerable progress is being made. Capitalize on this and use it to generate interest. Use transparencies to present information and slides to show various applications of structural principles.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Corner posts.	1. Corner post configurations. a. Principles involved 1) Rigidity 2) Provide inside and outside nailing surfaces b. Structures using three 2 x 4's c. Structures using two 2 x 4's, one 2 x 6 and a 3/8" plywood filler d. Structures using one 4 x 6 and one 2 x 6	1. Experiment with structural members placed at right angles to each other (as in a corner post). a. Test rigidity b. Test strength
B. Corner bracing.	1. Let in bracing a. 1" x 4" b. 1" x 6" 2. K bracing a. 1" x 4" let in b. 2" x 4" cut between studs 3. Solid bracing a. 1/2" x 4'-0" x 8'-0" plywood minimum b. 1/2" x 4'-0" x 8'-0" preferred c. Solid bracing to be thickness of sheathing	1. Vector and force relationship with the diagonal and K bracing.
C. Stud spacing	1. Spacing for accommodating interior and exterior materials. a. 16" on center b. 24" on center 1) These dimensions will accommodate all standard size materials 2. Spacing to provide adequate strength. 3. Laying out stud spacing. a. Room considerations b Exterior material considerations 4. Note: Although rough openings must be considered when spacing studs, it has been omitted here since it is covered in the next unit.	
D. Stud configurations for partition connections.	1. Partition connection configurations. a. Two 2 x 4's spaced approximately 2-1/2" apart b. 2 x 4's on normal spacing with 2 x 4's 2'-0" on center supporting 1" x 8" backing board	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Studying the principles of straight, plumb, square as they relate to partition framing.	1. Reading FHA Minimum Property Requirements to ascertain requirements for corner posts and spacing of studs.	
1. The geometry of angles. a. Computing b. Laying out c. Reading degrees and minutes		1. Study some famous structures to show the use of bracing or other structural arrangements of members. a. Flying butress of cathedrals b. The structure of the Eiffel Tower c. Suspension bridges d. Geodesic domes
1. Adding and subtracting dimensions--whole numbers and fractions. 2. Compiling running dimensions.	1. Add terms relating to wall framing to students' vocabulary list.	
		1. Discuss the impact of prefabricated or panelized house components on the small building industry.

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
	c. 2 x 6 or 2 x 8 at end of partition in exterior wall d. 2 x 4 spaced apart with a 2 x 4 2. Principle involved requires: a. Strength for providing rigidity in the partition b. Provides nailing edge for rock lath on inside	
E. Assembly and nailing schedules.	1. Layout of bottom and top plate to provide correct stud spacing. 2. Cutting studs to correct length. a. Finish room height b. Rough stud length 3. Assembly a. On the subfloor b. In place 4. Nailing. a. Two 10d common nails through when assembled on the subfloor b. Four 8d common nails toenailed when assembled in place 5. Panelized wall sections pre-assembled at a plant.	1. Study holding power of nails in straight and toenail positions.
F. Raising exterior wall framing and interior partitions.	1. Raise in the correct location a. Plumb in place b. Nail temporary supports to hold in place 2. Nail in place permanently.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
	1. Develop research skills in identifying sources of materials related to construction.	

III. APPLICATION

A. After presentation of principles and examples via transparencies, slides and models, have students assemble short sections of corner posts, partition junctures, and other structural configurations. Have students lay out stud spacing on plates and nail the wall section together. Stress accuracy of spacing to accept other building components, need for providing nailing surfaces and accuracy as it relates to square and plumb. Students should solve special individual problems on their models.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students sketch three different corner post arrangements.

B. Why must stud placement accept standard size sheathing materials.

C. What provisions must be made in the exterior stud wall to accept an interior partition.

D. What is toenailing?

E. What is a jack stud?

V. SUMMARY

A. Stud placement and spacing must provide for strength, rigidity, window and door openings, and also be so placed as to accept standard size sheathing material in the most economical fashion. Provision for partition connection with exterior walls and interior walls must also be considered. Correct nailing schedules and nailing procedures must also be observed.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and motivation

180 minutes -- Practical application

60 minutes -- Integrated concepts

60 minutes -- Work special problems on models

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Dunning, William J. and Robin, L. P., Home Planning and Architectural Drawing, New York: John Wiley & Sons, Inc., 1966.

2) Muller, Edward J., Architectural Drawing and Light Construction, Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967.

INSTRUCTOR'S UNIT PLAN

Unit 13
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Framing Window, Door, and Other Openings in Studded Walls and Partitions - Applying Sheathing

AIM:

To teach the correct header size selection, member arrangement, nailing procedures and applying sheathing.

INSTRUCTIONAL AIDS:

Transparencies - Door Construction AD-17, Window Details--Double Hung AD-18, Window Details--Miscellaneous AD-19, Fireplace Details and Design AD-21, Corners BC-14, Wall Assembly BC-15, Door Framing BC-16, Window Framing BC-17, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Film - Framing--Floor Joists and Walls, New York: Du Art Film Labs, Inc., 245 West 55th Street (25 minutes, 16 mm, sound, B & W, rent).

Slides - Teacher-made slides showing structural configurations relating to door, window and fireplace framing.

Models - Teacher or student-made models showing correct structural arrangement of wall members.

EQUIPMENT:

Overhead projector, 35 mm projector, screen, 2 x 4's, 2 x 6's, or other size framing lumber, hammer, nails, saws, squares, level.

PRIMARY REFERENCES:

1) Jones, R. P., Framing, Sheathing, and Insulation, Albany, New York: Delmar Publishers, Inc., 1964.

2) Newman, Morton, Standard Structural Details for Building Construction, New York: McGraw-Hill Book Company, 1968.

3) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Generate discussion relative to the need for structural strength around openings and direct attention to the correct method of framing around openings by the use of transparencies, slides, and models.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Openings in frame construction.	1. Rough openings. a. Rough opening sizes are usually specified in the literature describing doors and windows and the opening must be framed accordingly. b. Framing drawings also indicate rough openings with the width dimension first and the height dimension second.	
B. Headers.	1. Principle involved. a. Header must support the weight of the roof or other material over the window or door opening. 2. Use of header tables. 3. Header construction. a. Two thicknesses of header lumber plus 3/8" spacer b. Trussed headers 1) Maintenance of stud spacing 2) Truss design 3) Methods of cutting members and nailing c. Continuous headers used in panelized construction	1. The use of models to test structures. 2. Types of stress. a. Shear b. Torsion c. Tension d. Compression
C. Trimmer and jack studs.	1. Trimmer studs. a. Run through from sole plate to top plate. 2. Jack studs. a. Run from header to sole plate b. Nailed to trimmer stud 3. Use of double trimmers	
D. Rough sill.	1. Sets the bottom limit of the rough opening. a. May be doubled 2. Rough sill is supported by cripple studs.	
E. Applying sheathing.	1. Types of sheathing. a. Solid wood 1) 1" x 6" T & G 2) 1" x 8" S4S b. Plywood c. Wood fiber materials 1) Asphalt coated 2) Asphalt impregnated 3) Edge treatments a) Vee b) Lap edge c) Square edge	1. Study of man-fabricated materials. a. Manufacture b. Properties 2. Study of waterproofing qualities of asphalt or tar materials.

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Computation of rough opening sizes.		1. Study of working conditions in the construction industry. a. Weather conditions b. Time lost 2. Study social aspects of time lost due to inclement weather.
1. Computation of header sizes by computation of load bearing area and total weight. 2. Use of header span tables.	1. Reading charts and other span-size tables. 2. Verbal explanation of how to use span-size tables.	
		1. Wage demands of the construction industry. a. Per hour wages b. Annual wages c. Effect on inflation d. Effect on new home starts
	1. Letter writing requesting product information on sheathing material. 2. Understanding use of colons and semicolons in technical data.	

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	TECHNICAL CONCEPTS	SCIENCE
	4) Basic sizes a) 1/2"-25/32" thick b) 2'-0" x 8'-0" c) 4'-0" x 8'-0" 2. Application a. Solid wood 1) Horizontal 2) 45° diagonal b. Plywood and fiber material 1) Mainly horizontal 2) 4'-0" x 8'-0" sheets vertical	

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
	3. Practice in interpretation of technical information. a. Separating fact from advertising writing b. Use of glittering generalities	

III. APPLICATION

A. After introduction and presentation of the principles involved in framing around openings, have teams of students frame up to accommodate windows, doors, fireplaces, etc.

B. Demonstrate various methods of applying sheathing and cutting out for openings. Have students apply sheathing to the demonstration house and their models.

IV. EVALUATION CRITERIA GUIDELINE

A. How is the opening size determined for windows? Doors?

B. How are header sizes selected from header tables?

C. What is the principle of continuous headers in prefabricated construction?

D. Are jack studs continuous or cut for rough window sill framing?

V. SUMMARY

A. Openings in exterior and interior walls are potential weak points in frame construction. Therefore, the correct header size and structure must be selected to assure the necessary strength. The carpenter should be cognizant of correct header sizes and the arrangement of jack studs and rough window sill to provide greatest strength. Care must also be taken to assure that framing members are straight, plumb, or level as required.

VI. SUGGESTED TIME AND SEQUENCE LISTING

45 minutes -- Introduce and show film Framing--Floor Joists and Walls

60 minutes -- Integrated curriculum concepts

60 minutes -- Demonstration of principles

165 minutes -- Practical application and work on models

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Dunning, William J. and Robin, L. P., Home Planning and Architectural Drawing, New York: John Wiley & Sons, Inc., 1966.

2) Muller, Edward J., Architectural Drawing and Light Construction, Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967.

INSTRUCTOR'S UNIT PLAN

Unit 14
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Applying Double Plates and Placing Ceiling Joists

AIM:

To teach the tie-in principle of double plates and the correct method of spacing and nailing ceiling joists including partition attachment.

INSTRUCTIONAL AIDS:

Transparencies - Framing Elevations AD-24, Sections Elevations and Wall AD-25, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - Teacher-made, showing specific tie-in procedures for corners and partitions. Also transparencies showing methods of tie-in of partitions with the joists and perpendicular to joists--show nailing edges.

Models - Teacher-made models or mock-ups showing methods of tie-in with double plates.

EQUIPMENT:

Overhead projector, screen, 2 x 4's for double plates, 2 x 6's or 2 x 8's for ceiling joists, hammer, nails, saws and other necessary hand tools.

PRIMARY REFERENCES:

1) United States Department of Agriculture, Forest Service, Wood Frame House Construction, Agriculture Handbook No. 73, Washington, D. C.: U. S. Government Printing Office.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Elicit methods and generate discussion relative to how the side walls and partitions are tied together. Follow up with transparencies showing the principles and procedures used by the construction industry.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Applying double plates.	1. Function of double plates. a. To tie the structure together by planned lapping of the double plate over the single or top plate b. Doubling of the plate also provides strength and rigidity needed c. Provides strength to support ceiling joists	1. Tests of shear and tension to show how they relate to function of double plates.
B. Placing ceiling joists.	1. Structural considerations. a. Span-spacing requirements b. Placement for accommodating rock lath or other ceiling materials c. Placement to support interior partitions 1) Partitions parallel with joists 2) Partitions perpendicular to joists d. Providing nailing edges for ceiling materials e. Providing nailing edges or other support methods for decorative beams, etc. 2. Tie-in aspects of ceiling joists to hold side walls in place.	1. Discussion and demonstration of man-made ceiling and decorative materials. a. Manufacture of rock lath b. Manufacture of ceiling tiles c. Manufacture of acoustical tiles d. Manufacture of urethane or other foamed plastic beams, rosettes, etc.
C. Special considerations.	1. Cutting eave end to match slope of roof. 2. Ceilings in bay windows and other offsets. 3. Ceilings in flat roof structures. 4. Changes in direction of ceiling joists in special cases.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Estimating materials. a. Lineal footage plus waste b. Practical usable lengths 2. Computation of board footage.	1. Writing requisitions for materials. a. Correct form, order, and style b. Translation of piece quantity to board footage	
1. Use of span-spacing tables. a. Material size considerations b. Span considerations c. Spacing considerations d. Material species considerations 2. Estimating materials--number of ceiling joists required. a. Influence of joist spacing b. Trimmer and header joists around openings c. Double joists at partitions	1. Writing specifications for decorative beams, etc. 2. Reading material data sheets on ceiling tiles, decorative beams, etc. 3. Vocabulary building words such as: a. Urethane b. Foamed plastics c. Water fillable polyesters	1. Improvement of fire resistant qualities of ceiling materials and its importance in multiple dwellings and urban usage. 2. The social impact and changes of life styles in apartment dwellers and condominium dwellers.
	1. Writing descriptions of how to solve special ceiling framing problems.	1. Study grading standards for various ceiling and decorative materials. 2. Consider effects of quality and craftsmanship as it relates to synthetic materials.

III. APPLICATION

A. Use transparencies to illustrate how the double plates tie the side walls and partitions together. Also, point out the role of the ceiling joists in tying the structure together. Have students apply double plates and after practice and demonstration have them apply ceiling joists. Present methods of flat roof application and overhang. Also have students apply double plates and ceiling joists to their models. In all instances be sure students are aware of the necessity of nailing edges for rock lath.

IV. EVALUATION CRITERIA GUIDELINE

A. Sketch two methods of attaching interior partitions to ceiling joists.

B. What is the principle of double plate tie-in?

C. Why must nailing edges be provided at junctions of partitions to ceiling joists and exterior walls?

D. In what lengths can rock lath be purchased?

V. SUMMARY

A. Double plates must be correctly placed and nailed to assure structural integrity. Double plate nailing along with ceiling joist nailing provides the main means of holding the building together at ceiling line. Ceiling joist placement also serves as the spacing for roof rafters. However, extra joists may have to be provided to enable attaching of partitions. Nailing edges must be provided for rock lath or dry wall.

VI. SUGGESTED TIME AND SEQUENCE LISTING

20 minutes -- Introduction and motivation

40 minutes -- Presentation of principles involved

60 minutes -- Practical application of double plate principles

120 minutes -- Practical application of ceiling joist principles

90 minutes -- Presentation of integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Jones, R. P., Framing, Sheathing, and Insulation, Albany, New York: Delmar Publishers, Inc., 1964.

2) Lair, E. A., Carpentry for the Building Trades, New York: McGraw-Hill Book Company, 1953, 2nd Edition.

3) Sunderberg, Elmer W., Building Trades Blueprint Reading, Part I, Chicago: American Technical Society, 4th Edition.

INSTRUCTOR'S UNIT PLAN

Unit 15
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Gable Roof Construction

AIM:

To teach the principles and correct method of building a gable roof.

INSTRUCTIONAL AIDS:

Transparencies - Framing Plans and Details--Roof AD-23, Miscellaneous Frame Construction AD-27, Roof Types BC-18, Roof Nomenclature BC-19, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - Roof Framing, Part I, #15-0892-8, Roof Framing, Part II, #15-0899-3, Harrisburg, Pa.: 3M Business Product Sales, Inc., 3M Visual Products Division, 2101 Front Street North.

Film - Framing--Rafter Principles and Common Rafters, New York: Du Art Labs, Inc., 245 West 55th Street (15 minutes, 16 mm, sound, B & W, rent).

EQUIPMENT:

Overhead projector, 16 mm projector, screen, 2 x 6's or 2 x 8's as required for roof framing members, hammers, saws, nails, carpenter's square, level and other tools as required.

PRIMARY REFERENCES:

1) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

2) Wilson, Douglas J. and Werner, S. O., Simplified Roof Framing, New York: McGraw-Hill Book Company, 1948, 2nd Edition.

I. INTRODUCTION AND MOTIVATION

A. Show transparency of Roof Types and then lead discussion into how these roof types could be framed.

B. Show film Framing--Rafter Principles and Common Rafters and discuss important basic principles.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Roof types.	1. Develop an understanding of various roof configurations and their uses. Include: a. Flat b. Shed c. Gable d. Hip e. Butterfly f. Ell-shaped gable	1. Develop concept of water flow from sloped surfaces as it pertains to roofs. 2. Develop concept of wind resistance and wind lift as it applies to roof structures.
B Nomenclature of roof components.	1. Students must know the correct names of components of roof construction so that they know what part others are talking about. Develop an understanding of: a. Ridge b. Common rafter c. Valley rafter d. Gable rafter 2. Develop an understanding of layout terms. a. Line length of rafter b. Plumb or ridge cut c. Bird's mouth 1) Seat cut 2) Plumb cut d. Centerline of ridge e. Rise f. Run g. Overhang h. Slope i. Span j. Pitch	1. Study ventilation of roof structures. a. Convection patterns b. Conduction patterns
C. Rafter spacing.	1. Span-spacing considerations. a. 16" o.c. b. 24" o.c. c. Spacing start and stop in relation to ceiling joists 2. Effect of live and dead load on joist size selection.	1. Discuss weight of wind, water, snow and other forces on roof surfaces. 2. Compute dead weight on rafters and the weight of the rafters. Develop concept of density and specific gravity.
D. Framing openings in roofs.	1. Reinforcement of the principles related to trimmers and headers in framing openings.	
E. Roof anchoring.	1. Principle of attaining an integral structure. a. Nailing schedules b. Framing anchors or hurricane clips 2. Use of steel straps at ridge and attic subfloor.	1. Principle of shear stress in nailing framing anchors.
F. Collar beams.	1. Reinforcement of roof structure by means of collar beams.	1. Develop concept of reinforcement by the placement of the collar beam.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Geometry as it relates to angles and construction of geometric shapes. a. Erecting angles b. Bisecting angles	1. Writing technical reports. a. Identification of subject b. Logical arrangement of data c. Awareness of the audience	1. Study roof styles as they relate to climatic conditions. a. Water b. Snow load c. Temperature
1. Review of mathematical solution of right triangle. a. $H^2 = a^2 + b^2$ 2. Use of framing square. a. To compute plumb and seat cuts b. To compute rafter length c. To compute board footage	1. Development of vocabulary in relation to roofing terminology. 2. Reinforcement of principles of punctuation.	1. Discuss building codes as they relate to fire resistant qualities of roofing. 2. Discuss building height regulations in various building codes. a. Discuss the regulation of use of land as you wish and individual freedom
1. Reinforcement of figuring and adding continuous measurements for spacing of roof rafters.	1. Reading charts and information on roof framing plans.	
		1. Discuss some of the famous buildings of the world and point out interesting and technological aspects of the roof structures.
	1. Verbal explanation of the holding qualities of roof framing anchors in nontechnical terms.	

III. APPLICATION

A. Discuss principles involved in framing roof structures and develop an understanding of the strength requirements. Demonstrate the use of the framing or carpenter's square in the figuring of rafter lengths and cuts. Have students practice laying out rafters for various rises and runs. Demonstrate framing layout for hip roof configurations and have students practice layouts and cuts. Have students erect the roof structure on the practice house and also on their models. Correlate science and math aspects to aid in understanding of strength and geometry of the angles involved.

IV. EVALUATION CRITERIA GUIDELINE

A. List three types of roofs used in residential buildings and indicate properties of each.

B. What is the pitch of a roof?

C. What is the bird's mouth?

D. What are the names of the structural members in an ell-shaped hip roof configuration?

E. Sketch a framing plan for a gable roof on an ell-shaped structure.

V. SUMMARY

A. The roof framing is a very important aspect of any building since the framing forms the structural skeleton which supports the roof sheathing and actual roof covering. The student must know various types of roofs and be able to lay out, cut, and erect the structural members correctly and efficiently.

VI. SUGGESTED TIME AND SEQUENCE LISTING

45 minutes -- Introduction and motivation

60 minutes -- Use of the framing square

60 minutes -- Practice in laying out rafters

105 minutes -- Practical application in laying out, cutting, and erecting rafters

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Lair, E. A., Carpentry for the Building Trades, New York: McGraw-Hill Book Company, 1953, 2nd Edition.

2) Townsend, Gilbert, Steel Square, Chicago: American Technical Society, 1951.

INSTRUCTOR'S UNIT PLAN

Unit 16
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Roof Truss Construction

AIM:

To teach methods of constructing basic gable roof type trusses.

INSTRUCTIONAL AIDS:

Slides - Teacher-made slides of roof truss forms and configurations. Also slides of steps in assembling roof trusses.

Film - Story of the Weldwood House, New York: U. S. Plywood Corporation, Sales Promotion Department, 777 Third Avenue (26 minutes, 16 mm, sound, color, free).

Models - Teacher-made models of various roof truss forms.

EQUIPMENT:

35 mm slide projector, 16 mm projector, screen, 2 x 6's, 2 x 8's, saws, hammers, carpenter's square, level, and other tools needed for roof framing.

PRIMARY REFERENCES:

1) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Pass out sheets showing comparative costs of roof structures erected by conventional methods and structures erected by truss methods. Use this material to generate discussion concerning the advantages and disadvantages of roof truss construction.

B. Show film Story of the Weldwood House and discuss pertinent production methods.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Truss nomenclature.	1. Discuss names of component parts and the reason for their names. a. Top chord b. Bottom chord c. Tension web d. Compression web e. Plumb cut f. Seat cut g. Gusset h. Gang nail plate	1. Force vectors. a. Tension web forces b. Compression web forces 2. On a truss loading is usually a matter of simple compression or tension on web or strut members.
B. Truss design.	1. Truss used most commonly in small house construction: a. W or Fink truss b. Scissors truss 2. Design tables and layout of trusses. a. Span considerations b. Top chord and web connection location c. Bottom chord and connection location d. Sizes of structural members 3. Camber on bottom chord.	1. Reasons for being able to use smaller size structural members.
C. Connection fastening procedures.	1. Types of connectors used. a. Plywood or steel truss plates and nails b. Bolts and washers c. Split ring connector d. Truss plates or gang nails 2. Application methods: a. Correct nailing schedules b. Correct split ring application c. Application of gang nails	1. Strength tests conducted on joints assembled with various types of fasteners.
D. Assembly procedures.	1. Layout and cutting of pattern members. a. Select straight material b. Lay out accurately c. Cut accurately 2. Lay out form on subfloor. a. On small jobs or when only a few trusses are required they are frequently assembled on the subfloor	

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Spacing of components. a. 1/4 span b. 1/3 span 2. Review of fractions and percentages.		1. Study of some famous buildings which have utilized the principle of truss construction.
1. Computing roof slope. a. Translating rise and run (overall) into 12" slope statement 2. Computation of bottom chord deflection or camber requirements to compensate for initial weight sag.	1. Write descriptive specifications to accompany drawings for ordering of roof trusses. 2. Read architectural specifications regarding roof truss construction.	
	1. Examine FHA Minimum Property Requirements to find regulations concerning truss roof construction.	1. The impact on the economy of the utilization of technological advances in the construction industry. 2. Discuss wages in the construction industry. Consider: a. Skill vs. wages b. Quality of work vs. wages c. Quantity of work vs. wages d. Effect of high wages and prevailing wage laws on taxes as reflected by cost of public buildings
1. Present geometric principles required to permit layout and checking of truss form on subfloor or jig table. 2. Spacing of trusses on double plate. 3. Estimating materials required to construct trusses. 4. Estimating labor time required.		1. Reinforcement of understanding of mass production and interchangeability of parts. 2. Study of cost savings by using unskilled labor to assemble trusses after skilled labor has provided jig form and accurately cut members. 3. Promotion possibilities of unskilled labor in mass production situations.

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	TECHNICAL CONCEPTS	SCIENCE
	3. Building a truss jig table or use of metal table. a. Large quantities of trusses usually are more efficiently produced on a jig table b. Metal truss tables with adjustable positioning clamps are usually used by industrial producers	
E. Erection procedures.	1. Hoisting trusses to plate level by gin pole and pulleys. 2. Hoisting trusses to plate level with forklift or crane. 3. Sliding trusses along plate to correct position. 4. Nailing or fastening procedures. 5. Temporary bracing until roof sheathing is applied.	1. Mechanical advantage obtained by use of pulleys or block and fall.

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
	1. Write essays on safety considerations in regard to erecting trusses. a. Check exactness of wording for concept to be conveyed b. Check punctuation	

III. APPLICATION

A. Show film and present principles of truss design and explain the use of charts and drawings of trusses as designed by various agencies and companies. Have students design trusses and set up sketch form or jigs to assemble a number of trusses. Have students erect pole and pulleys to hoist trusses into place--space trusses and nail them in place using correct nailing practices. Have students make trusses for their models and apply them. In all cases, have students use appropriate truss design, construction practices, spacing, and erection procedures.

IV. EVALUATION CRITERIA GUIDELINE

A. Have students explain the economics of truss construction and use.

B. Have students translate span, slope, and loading factors into the right truss for the job.

C. What is the principle which permits the use of smaller structural components in truss construction?

D. What is meant by a W truss?

V. SUMMARY

A. The use of trusses in residential and light construction has grown considerably in the last few years and the financial savings forecast an increase in their use in the future. Students and contemporary carpenters should be familiar with truss construction principles and erection procedures.

VI. SUGGESTED TIME AND SEQUENCE LISTING

45 minutes -- Introduction and motivation

75 minutes -- Presentation of the principles of truss construction

60 minutes -- Integrated curriculum concepts

120 minutes -- Practical application--truss construction and erection

30 minutes -- Work on models

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

None

INSTRUCTOR'S UNIT PLAN

Unit 17
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Hip Roof Construction

AIM:

To teach the principles and processes of framing for hip roofs.

INSTRUCTIONAL AIDS:

Transparencies - Framing Plans and Details--Roof AD-23, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - Roof Framing, Part II, #15-0899-3, Harrisburg, Pa.: 3M Business Product Sales, Inc., 3M Visual Products Division, 2101 Front Street North.

Film - Framing--Hip and Valley Rafters, New York: Du Art Film Labs, Inc., 245 West 55th Street (25 minutes, 16 mm, sound, B & W, rent).

Models - Teacher-prepared models of various hip roof components and configurations.

EQUIPMENT:

Overhead projector, 16 mm projector, screen, 2 x 6's, 2 x 8's, saws, carpenter's square, hammer, level, nails and other tools required for roof framing.

PRIMARY REFERENCES:

1) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

2) Wilson, Douglas J. and Werner, S. O., Simplified Roof Framing, New York: McGraw-Hill Book Company, 1948, 2nd Edition.

I. INTRODUCTION AND MOTIVATION

A. Use transparencies and film Framing--Hip and Valley Rafters to introduce the more complex roof form as exemplified by the hip roof. Discuss the hip roof and its relationship to house style and the savings in gable end framing and maintenance.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Nomenclature of hip roof components.	1. Develop an understanding of correct names of hip roof structural components. a. Ridge b. Hip rafter c. Common rafter d. Hip jack e. Cripple jack 2. Layout terms a. Line length of rafter b. Plumb cut c. Seat cut d. Bird's mouth e. Rise f. Run g. Bevel cut h. Compound bevel cut	
B. Figuring length and cuts of hip rafters and valley rafters.	1. Length is diagonal of the square formed by the walls and common rafters. a. Shortening one half the horizontal thickness of the ridge b. Side cuts by rafter table on square c. Seat cuts	1. Reinforcement of the concept of force vectors as they apply to loads on roofs. a. Distribution of loads via hip roof components b. Forces on outer walls
	2. Valley rafter has bevels cut on both ends.	
C. Laying out and cutting hip jack and cripple jack rafters.	1. Finding common difference 2. Laying out and making side cuts. 3. Making bottom side cuts.	
D. Erecting roofing members.	1. Common rafters and hip or valley rafters same as common rafters for gable roof. 2. Jack rafters erected in pairs. 3. Nailing schedules.	1. Concept of opposing forces. a. Opposite and equal b. Unequal

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
	1. Develop ability to read technical literature. a. Reading relatively clear and simple information 1) Rapid reading 2) Rapid comprehension b. Reading complex instructions such as directions for how to cut hip roof components 1) Slower careful reading 2) Sometimes difficult to comprehend	
1. Computation of angles. a. Simple angles b. Compound angles 2. Computation of diagonal measurements when other two dimensions are known.		1. Study aspects of prefabricated or mass produced housing and housing components.
1. Complementary angles. 2. Acute angles. 3. Obtuse angles.		1. Consider the effects of mobile homes on housing construction. 2. How do mobile homes affect land use patterns and tax structures of communities?

III. APPLICATION

A. Introduce the topic, show and discuss the transparencies relating to hip roof and then show the film Framing--Hip and Valley Rafters. Demonstrate how to figure the length and cuts of the hip, valley, hip jack, valley jack and cripple jack rafters. Have students practice laying out and cutting rafters for various situations and have them erect a roof structure. Have students apply hip roofs to various models and ascertain that they know the various rafter names.

IV. EVALUATION CRITERIA GUIDELINE

A. A roof with uniform slope on all sides of a building is a _____ roof.

B. What type angle cut must be made where the hip rafter intersects the ridge and common rafter?

C. How is ventilation obtained on a hip roof?

D. Explain how to figure the length and cut on hip, valley, and hip jack rafters.

V. SUMMARY

A. The hip roof is one of the more complicated roof structures to erect. It has advantages in that no gable end painting, erection cost, or maintenance is required. However, frequently these savings are lost because of inefficient labor in erecting the hip roof. Hence, the structural carpenter should know how to layout, cut, and erect hip roof members.

VI. SUGGESTED TIME AND SEQUENCE LISTING

40 minutes -- Introduction and show film: Framing--Hip and Valley Rafters

40 minutes -- Mathematics concepts

60 minutes -- Demonstrate layout and cutting members

130 minutes -- Practical application

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Brown, Walter C., Basic Mathematics, Homewood, Ill.: Goodheart-Willcox Company, Inc.

2) Jones, R. P., Framing, Sheathing, and Insulation, Albany, New York: Delmar Publishers, Inc., 1964.

INSTRUCTOR'S UNIT PLAN

Unit 18
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Cornice Construction and Exterior Trim

AIM:

To present procedures for exterior trim application and teach how to erect framing members for various types of cornices.

INSTRUCTIONAL AIDS:

Transparencies - Cornice Construction Details AD-16, Wall Section BC-7, Roof Types BC-18, Front Elevation BC-20, Right Elevation BC-21, Philadelphia: DCA Educational Products, Inc., 4865 Stenton Avenue.

Transparencies - Exterior Trim #15-0902-5, Harrisburg, Pa.: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Film - Rain Carrying Equipment, New York: Association's Films, 347 Madison Avenue (21 minutes, 16 mm, sound, color, free).

Samples - Samples of various moldings and wood used for exterior trim.

EQUIPMENT:

16 mm projector, overhead projector, screen.

Hammer, saws, miter box, level, planes, nail sets, wood and molding as required.

PRIMARY REFERENCES:

1) Jones, Raymond P., Interior and Exterior Trim, Albany, New York: Delmar Publishers, Inc.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. Have display of various types of moldings, trim boards and sidings for students to view and handle. Generate discussion on how this may be applied to enhance the appearance of a house. Discuss advantages and disadvantages of various aspects and lead into the subject of the lesson.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Nomenclature of cornice construction.	1. Lookouts. a. Sizes b. Spacing c. Nailing 2. Nailer or ledger. a. Size b. Location 3. Fascia. a. Size 4. Soffit or plancier. a. Sizes b. Types 1) On-site made 2) Manufactured 5. Frieze. a. Sizes b. Nailing 6. Bed molding.	1. Airflow and necessity for ventilating vents and louvres. a. Principles of convection
B. Rake nomenclature.	1. Lookouts. a. Sizes b. Spacing c. Nailing 2. Trim molding. a. Sizes b. Location 3. Fascia - Rake. a. Size 4. Frieze board - Rake. 5. Bed molding - Rake.	
C. Cornice and rake types.	1. Closed cornice. a. No rafter extension 2. Box cornice. a. Rafter forms nailing surface to fascia and soffit boards 3. Wide box cornice. a. Rafter forms nailing surface for fascia b. Lookouts form nailing surface for soffit 4. Variations of box cornice. 5. Open cornice. a. Rafters exposed in soffit area 6. Box rake. 7. Closed rake. 8. Cornice or rake returns. 9. Water tables.	1. Forces of winds in hurricanes and tornadoes. a. Pressure b. Vacuum

TO BE DEVELOPED

MATH	COMMUNICATIONS	SOCIAL STUDIES
1. Figuring material lengths. a. Lookouts b. Soffits 2. Computing ventilating areas. a. Attic volume b. Louvre area c. Soffit vents 3. Computing solar orientation and length of cornice overhang to control sun's rays.	1. Writing for technical data on commercial soffit systems.	
		1. The influence of geography and climate on type of rake and cornice used. a. Snow b. Rain c. Sun
1. Computing quantities of materials required.	1. Reading material specifications. 2. Reading and understanding installation instructions. a. Written information b. Drawings and sketches	

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
D. Window and door trim.	1. Window casing in frame construction. 2. Brick molding in brick and brick veneer construction. 3. Drip caps. a. Frame construction b. Brick construction at gable ends 4. Threshold installation.	1. Principles of insulating glass.
E. Exterior finish siding.	1. Horizontal types. a. Bevel b. Wide bevel c. Rustic and drop d. Shadow line and drip 2. Vertical types. a. Board and batten b. Tongue and groove c. Recessed batten 3. Wood and mineral fiber shingles. a. Individual units b. Strip units 4. Plywood siding. a. Striated b. Texture and reversed board and batten c. Rough sawn d. Textured 5. Aluminum types. 6. Corner systems. a. Metal corners b. Wood corners	1. Technology of paints. a. Breathing characteristics b. Pigment types c. Binders 2. Plastic finishes. a. Vinyl over wood b. Vinyl over aluminum
F. Flashing.	1. At window and door jointures. 2. At jointures of brick and frame construction.	1. Principles of water shedding and water flow. 2. Hydrostatic pressures.

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
		1. Study window and door styles of various periods of history. Relate this to: a. Historic events b. Architects and house styles c. Esthetics
1. Estimating amount of siding required by square footage. 2. Figuring the percentage of the area to be added for various types of laps.	1. Building vocabulary related to siding and its application. 2. Writing reports about various types of sidings and visible effects which may be gained from various applications.	1. Study of housing styles as they relate to periods of history and technology. Consider: a. Log cabins b. Hand split shingles c. Hand sawn boards d. Shiplap e. Etc.
1. Developing an understanding of gauges of metal and their decimal equivalents.		

III. APPLICATION

A. Lead into lesson and use transparencies to present basic principles. Follow up with discussion of the materials used and how they are applied. Demonstrate structural aspects and have students apply a box cornice to the practice structure. Have students apply various types of cornices to their models so that a variety of cornice configurations are evident. In a similar manner apply siding.

IV. EVALUATION CRITERIA GUIDELINE

A. Sketch methods of framing and applying structural framing and finish members to closed box, box, and open cornices.

B. How and when is brick molding applied to a door or window frame.

C. Explain how flashing and drip cap are applied to a window in frame construction.

D. How do you apply vertical board and batten siding?

V. SUMMARY

A. The application of exterior siding, trim and cornices has much to do with the final appearance of a house. The members must be correctly applied to provide a sound weatherproof structure. Also, the quality of work and tightness of joints is important for appearance purposes. Students must develop the skills and knowledge necessary to do this work.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and motivation

60 minutes -- Presentation of principles involved

120 minutes -- Practical application

60 minutes -- Work on models

60 minutes -- Integrated curriculum concepts

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Ulrey, Henry F., Carpenter's and Builder's Library, Vol. #4, Indianapolis: Theodore Audel, 1967.

2) Various technical bulletins and catalogues on molding, sidings, and cornice systems.

INSTRUCTOR'S UNIT PLAN

Unit 19
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Interior Trim

AIM:

To present procedures and methods of interior trim application especially as it relates to interior doors and sanitary baseboards.

INSTRUCTIONAL AIDS:

Transparencies - Interior Trim #15-0901-7, Harrisburg, Pa.: 3M Business Product Sales, Inc., 3M Visual Materials Division, 2101 Front Street North.

Film - Fundamentals of Stair Layout, New York: Du Art Labs, Inc., 245 West 55th Street (11 minutes, 16 mm, sound, B & W, rent).

Film - Stairway Construction, Los Angeles: University of California, Department of Cinema, University Park (23 minutes, 16 mm, sound, B & W).

Samples - Samples of interior trim, moldings, and door frames.

Slides - Show teacher-made slides of quality interiors featuring various types of trim and cabinetwork.

EQUIPMENT:

16 mm projector, overhead projector, screen, trim material, doors and door frames, necessary tools and nails.

PRIMARY REFERENCES:

1) Jones, Raymond P., Interior and Exterior Trim, Albany, New York: Delmar Publishers, Inc.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

I. INTRODUCTION AND MOTIVATION

A. If possible, tour a house under construction and one which is completed and indicate the skill and procedures used to produce a quality finished job. Show slides of quality trim and millwork. Lead discussion to elicit responses relative to an attitude of craftsmanship and pride in finish carpentry. Lead from this discussion into the lesson.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Setting interior door frames.	1. Plumbing and squaring door frame in opening. a. Centering side jamb in opening with double shingle wedges b. Plumbing side jamb to plumb side of rough opening c. Squaring head to side jambs 2. Nailing procedure. a. Two nails through side jamb, at about 18" spacing. b. One of the two nails under door stop or slam strip	1. Applications of the wedge as a basic machine and also as an adjusting device.
B. Door casing.	1. Reveal or setback from edge. a. Usually 1/4" 2. Measure length and cut 45° miters of side casings. 3. Measure length and cut 45° miters of top casing. 4. Nail in place.	
C. Hanging doors.	1. Door types. a. Panel doors b. Flush doors 1. Solid core 2. Hollow core 3. Fiber core 2. Door sizes. a. Exterior doors are usually 1-3/4" thick, 2'-8" or 3'-0" wide, and 6'-8" or 7'-0" high. b. Interior doors are usually 1-3/8" thick by 6'-8" high. Widths range from 1'-0" to 3'-0" usually by 2" increments. 3. Door clearance. a. Hinge side - 1/16" b. Lock side - 1/16"-3/32" c. Top - 1/16"-3/32" d. Bottom - 5/8" or to clear carpet e. Clearance bevel - 3-1/2 degrees or 1/8" in 2" 4. Setting hinges. a. Location 1) Top hinge 7" from top 2) Bottom hinge 11" from bottom 3) Center hinge in center of space left. b. Cutting hinge gains 1) By hand 2) By router	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Reinforcement of principles of plumb, level, and square.	1. Building vocabulary as it relates to finish carpentry. a. Door terminology b. General trim terminology c. Joining terminology	1. Study of trends in length of the work day and work week. a. Trend toward shorter total hours b. Four days - forty hours c. Overtime regulations
1. Development of understanding of the principles of miters. 2. Points of origin for miters as they relate to figuring lengths of members.	1. Reading literature related to architecture, particularly in terms of balance and proportion.	
1. Generation of a line around a point (pivot of a hinge) to indicate necessity of bevel for door clearance.	1. Reading and applying manufacturer's directions related to hanging or fitting doors.	1. Comparison of working conditions of a finish carpenter with those of rough construction carpenters. 2. Discussions relative to responsibility in terms of correct fitting and operating doors.

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	TECHNICAL CONCEPTS	SCIENCE
D. Installing lock sets.	1. Lock set types. a. Mortise b. Cylinder c. Tubular d. Unit 2. Setting locks. a. Follow manufacturer's directions 1) Mark doors 2) Bore holes 3) Set latch unit 4) Install latch strike 5) Install lock set and knobs	
E. Installing prehung and sliding doors.	1. Types. a. Prehung solid jamb b. Prehung split jamb c. Pocket sliding d. By-pass sliding e. Folding doors 2. Installation--always follow manufacturer's directions. a. Reinforce concepts of accurate measurement b. Be sure items are plumb and square 3. Knowledge of adhesives and other fasteners used in pre-assembled structures.	1. Use of adhesives. a. Properties of adhesives b. Understanding of terms of adhesion, cohesion, and fusion. 2. Concepts of/or theories related to adhesives. a. Mechanical theory b. Specific adhesion theory
F. Installing window trim, baseboards, and other moldings.	1. Setback or reveal from edge usually 1/4". 2. Need for accurate measurements. 3. Cutting miters. a. Use of miter box b. Use of wood trimmer 4. Cutting miters other than 45°. 5. Coped joints. a. Advantages b. Method of cutting 6. Nailing and installing procedures.	1. Explanation of why blunt point nails split wood less than sharp chisel point nails.

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Geometry as it relates to intersections of circles and arcs as it relates to need for accuracy in boring holes for setting locks. 2. Dividing fractions.	1. Writing letters requesting literature on various prehung door assemblies. Consider: a. Accuracy of terminology b. Explicitness of request c. Courtesy aspects d. Punctuation--spelling	1. Considerations in terms of utilization of locks in contemporary society. a. Privacy b. Fire safety c. Burglary
1. Cost analysis in terms of on-site hanging of doors and prehung doors.	1. Reading and applying information from technical literature relative to prehung doors of various types.	
1. Geometry involved in cutting shaped surfaces. a. Effect of a 45° plane cut b. Effect of a plane cut other than 45° c. Application of the above to coped joints		

III. APPLICATION

A. Introduce lesson and show film Fundamentals of Stair Layout. Even though the lesson does not deal with stair construction, the principles of accuracy are transferable and form a good basis for discussion on finish carpentry. Demonstrate methods of installing door frames, prehung units, sliding doors, casings and baseboards. Apply principles involved in the practice structure. Place emphasis on accuracy and neatness of work. If practical, apply principles to student models.

IV. EVALUATION CRITERIA GUIDELINE

A. Explain how to install, plumb, and square a door frame.

B. Demonstrate how to lay out and cut a coped joint.

C. What is meant by the term reveal?

D. Explain how to install a passage lock set.

E. Why is a bevel planed on the leading edge of a door?

V. SUMMARY

A. Correct fitting and operating doors add much to the enjoyment of a housing structure. Ill fitting doors and poorly fitted trim are points of constant annoyance since they are constantly in mind through use and observation. The finish carpenter has a very important job and his work can be rewarding and provide much pride. Students should develop the skills and knowledge required for finish work.

VI. SUGGESTED TIME AND SEQUENCE LISTING

30 minutes -- Introduction and motivation

90 minutes -- Demonstration of principles

75 minutes -- Integrated curriculum concepts

120 minutes -- Practical application

45 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Ulrey, Henry F., Carpenter's and Builder's Library, Vol. #4, Indianapolis: Theodore Audel, 1967.

2) Various technical bulletins and catalogues on doors, windows and moldings.

INSTRUCTOR'S UNIT PLAN

Unit 20
Lesson 1
Time 6 Hours

CLUSTER: CONSTRUCTION

DIVISION: WOOD STRUCTURAL FRAMING

SUBJECT: Scaffold Erection and Construction

AIM:

To teach how to erect metal scaffolding and build wood scaffolds.

INSTRUCTIONAL AIDS:

Transparencies - Teacher-made transparencies showing principles and methods of wood scaffold construction.

Slides - Teacher-made slides showing constructed scaffolding and commercial metal scaffolds in place.

EQUIPMENT:

Overhead projector, 35 mm slide projector, screen, materials for building wood scaffolds and samples of various types of metal scaffolds.

PRIMARY REFERENCES:

1) Ulrey, Henry F., Carpenter's and Builder's Library, Vol. #4, Indianapolis: Theodore Audel, 1967.

2) Wagner, Willis H., Modern Carpentry, Homewood, Illinois: Goodheart-Willcox Company, Inc., 1969.

INTRODUCTION AND MOTIVATION

A. Discuss need for scaffolding to enable men to work at some height above ground and point out the need for safe structures. Show slides of scaffolds in various applications and proceed with the lesson.

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
A. Material selection.	1. Select only clear, sound, straight grained material. a. If knots are present they must be sound and straight b. No splits or checks 2. Sizes. a. Uprights are sized according to height to be scaffolded 1) Minimum size - 2" x 4" 2) Common size over 8'-0"--4" x 4" b. Ledger blocks minimum size - 2" x 6" c. Cross ledgers doubled--2" x 4" or single 2" x 6" d. Walk planks - 2" x 10"	1. Tests to compare strength of straight grained wood with slash grained wood.
B. Construction types.	1. Two pole structures. 2. Single pole with ledger blocks. 3. Lean-to. 4. Suspended.	
C. Construction principles.	1. Uprights should be straight and plumb and braced to prevent flexing. 2. Base pads should be adequate size to prevent sinking into soil. 3. Wall ledgers should be securely nailed to wall. 4. Cross ledgers should be level and securely attached to uprights and/or wall ledgers. 5. Cross ledgers must be spaced to accept platform boards and usually not more than 5'-0" apart.	
D. Construction methods.	1. Preparation of site. a. Leveling b. Clearing debris 2. Placement and sizing of foot pads. 3. Placement and nailing of wall ledgers. 4. Plumbing uprights and nailing cross ledgers. 5. Nailing cross braces.	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
1. Review span strength formulas and computations as they relate to scaffold structures.	1. Read about Leonardo da Vinci in terms of some of his inventions and structures. 2. Reading for understanding.	1. Investigate use of elevators on construction sites. a. Personnel elevators b. Material elevators c. Hoists for brick and block, etc. to scaffolds
1. Review geometry principles as they relate to bracing. a. Strength of a square structure b. Strength of a cross-braced structure c. Strength loss from bowing or flexing of members		
	1. Read literature on various buildings and their architects. a. Develop appreciation for aesthetics in both writing and art b. Develop appreciation for men involved	1. Discuss scaffolding or methods used to construct famous structures. a. Pyramids b. Colosseum c. Saint Paul's Cathedral

II. PRESENTATION OF INTEGRATED CONCEPTS

RELATED CONCEPTS

INSTRUCTIONAL TOPICS	*TECHNICAL CONCEPTS*	*SCIENCE*
	6. Placing walk planks. 7. Nailing guard rail.	
E. Manufactured scaffolding.	1. Presentation of types. 2. Bracing methods. 3. Height-width relationship for railing staging. 4. Erection methods. 5. Maintenance procedures.	
F. Ladders.	1. Types. a. Extension b. "A" ladders c. Stepladders 2. Materials a. Wood b. Aluminum c. Magnesium 3. Uses. a. Inspect before use. b. Be sure feet rest on a solid level or leveled surface c. Check height slope relationship	

TO BE DEVELOPED

MATH	*COMMUNICATIONS*	*SOCIAL STUDIES*
		1. Investigate safety regulations of Bureau of Labor and Industry relative to use of scaffolds and ladders.

III. APPLICATION

A. Discuss principles of material selection, bracing for rigidity, and bracing for strength. Use transparencies to show methods of construction and follow up with practical application and construction scaffolds. Erect several types of manufactured scaffolding to illustrate methods of assembly.

IV. EVALUATION CRITERIA GUIDELINE

A. List safety rules relative to construction and use of scaffolds.

B. Why must clear, knot-free lumber be used for scaffolds?

C. What precaution must be taken to prevent the uprights of scaffolds from sinking into the ground?

D. Why should joint systems on metal scaffolding be kept free of rust and other foreign matter?

E. What is the maximum allowable spacing of horizontal support sections in scaffold construction?

V. SUMMARY

A. Scaffolds or staging are frequently used to enable men to work at some height on building construction. These structures must be strong enough to support men and materials with a high degree of safety. Therefore, the carpenter must know the correct and safe methods of erecting and using scaffolds.

VI. SUGGESTED TIME AND SEQUENCE LISTING

20 minutes -- Introduction and motivation

60 minutes -- Presentation of principles and methods

100 minutes -- Integrated curriculum concepts

150 minutes -- Practical application

30 minutes -- Summary and evaluation

VII. SUPPLEMENTAL REFERENCES AND RESOURCE MATERIAL

1) Various catalogues and bulletins on manufactured scaffold and staging systems.

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Atkinson, Henry F., Rough Carpentry and Masonry, New York: McGraw-Hill Book Company, 1969.

Burbank, Nelson L., House Carpentry and Joinery, New York: Simmons-Boardman Publishing Corporation, 1952, 5th Edition.

Carpentry: A Course of Study Designed for Cooperative Part-Time Students Employed in the Carpentry Trade, Columbia, Missouri: University of Missouri, College of Education, Department of Industrial Education, 1955.

Conner, Frank L., Carpentry Handbook, Greenwich, Conn.: Fawcett Publications, Inc., 1957.

DeCristoforo, Romeo J., The Practical Handbook of Carpentry, New York: Arco Publishing Company, Inc., 1969.

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Practical Problems in Mathematics for Carpentry Trades, Albany, New York: Delmar Publishers, Inc., 1962.

Smith, Hervey G., Boat Carpentry, Princeton, New Jersey: D. Van Nostrand Company, Inc., 1965, 2nd Edition.

Smith, Ronald C., Principles and Practices of Light Construction, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970, 2nd Edition.

Stieri, Emanuele, Complete Home Repair Handbook, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1950.

Suggested Problems for Carpenters: Mathematics, Albany, New York: Delmar Publishers, Inc., 1948.

Suggested Unit Course in Concrete Form Construction, Albany, New York: Delmar Publishers, Inc., 1946.

Suggested Unit Course in Interior and Exterior Trim, Albany, New York: Delmar Publishers, Inc., 1946.

Townsend, Gilbert, Carpentry: A Practical Treatise on Simple Building Construction, Chicago: American Technical Society, 1949.

Ulrey, Harry F., Carpentry and Building, Indianapolis: Theodore Audel, 1966.

Wilson, J. D. and Rogers, C. M., Carpentry Mathematics, New York: McGraw-Hill Book Company, 1949, 2nd Edition.

Wilson, J. D. and Rogers, C. M., Simplified Carpentry Estimating, New York: Simmons-Boardman Publishing Corporation, 1948, 4th Edition.

Wilson, J. D. and Werner, S. O., Simplified Stair Layout, Albany, New York: Delmar Publishers, Inc., 1947.

Woodin, James C. and Hayes, Louis E., Home and Building Maintenance, New York: McKnight & McKnight Publishing Company, 1969.